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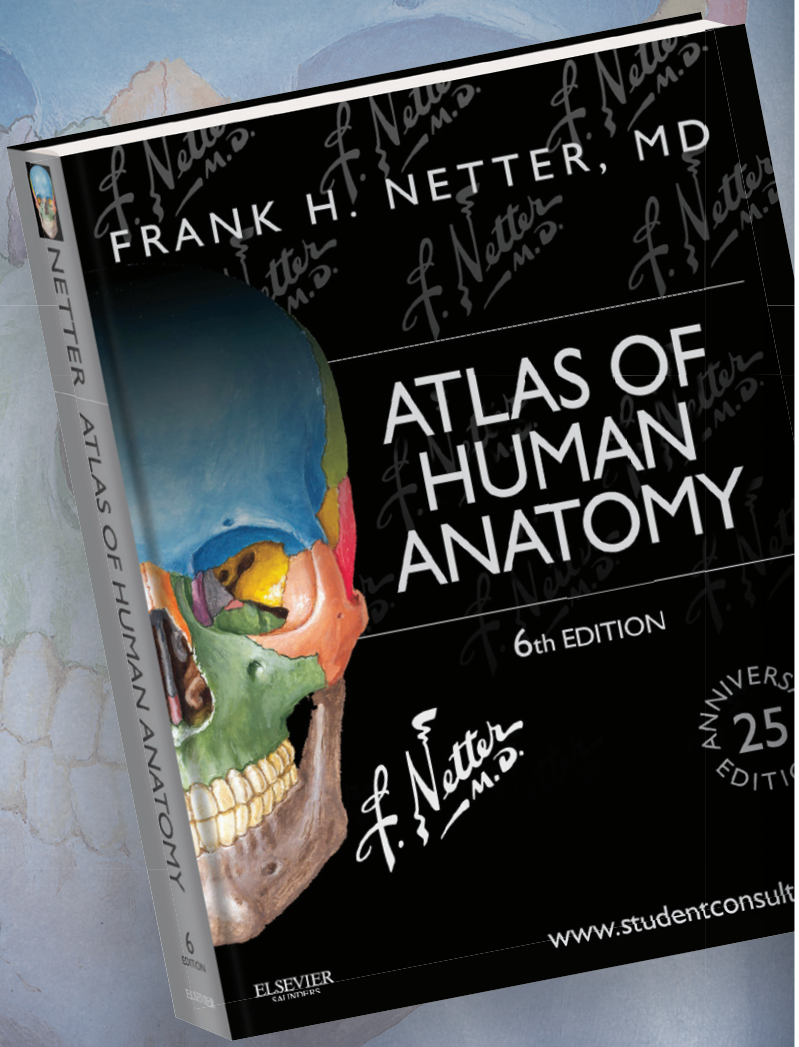
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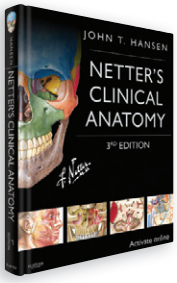
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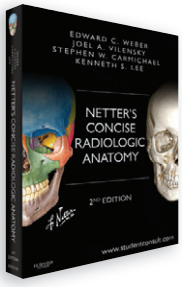
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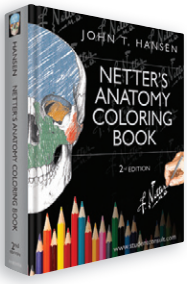
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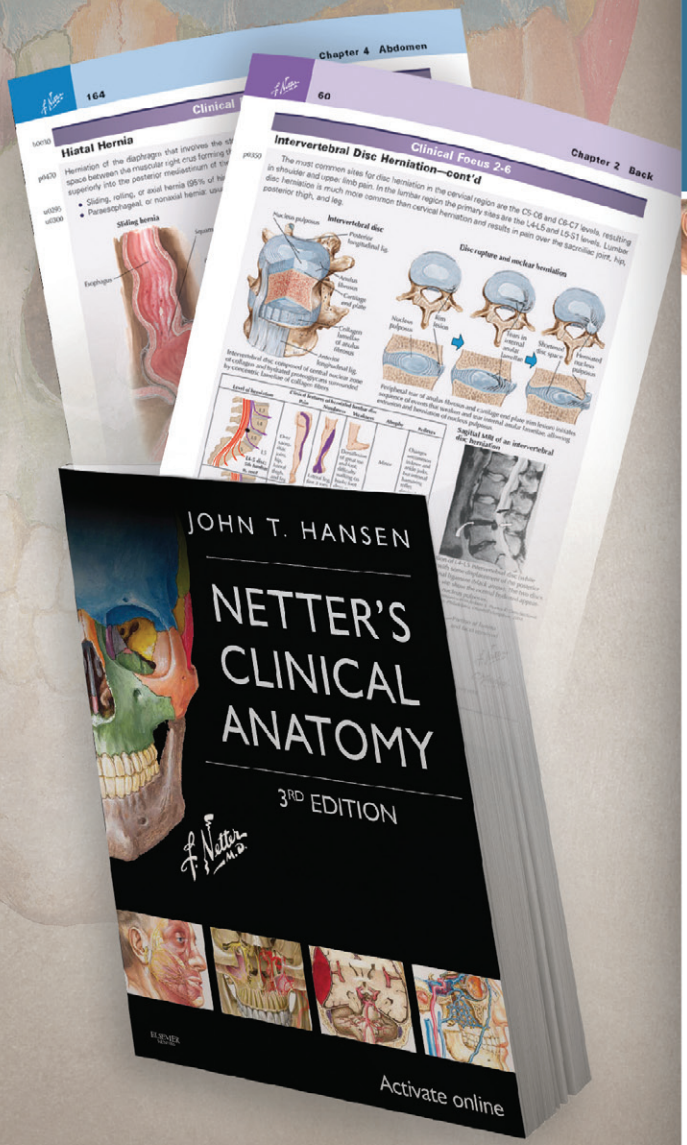


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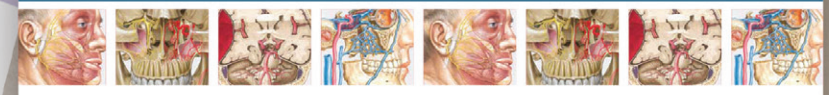


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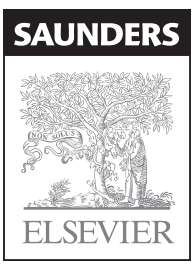
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Frank H. Netter, MD



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Netter's Atlas of Human Anatomy – Celebrating 25 Years

"Anatomy, of course, does not change, but our understanding of anatomy and its clinical significance does."

– **Frank H. Netter, MD**

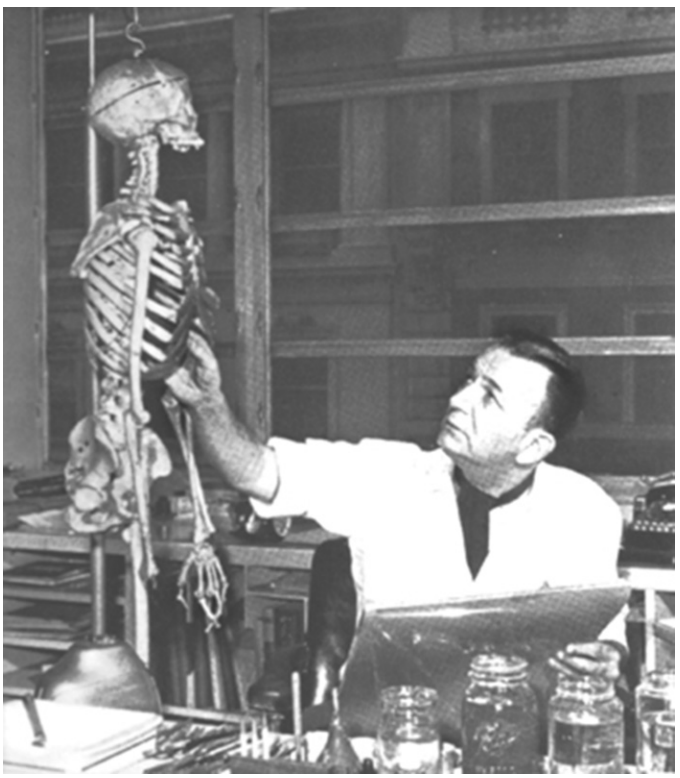
Whether you're using this 6th edition of ***Atlas of Human Anatomy*** in print, as an e-Book, online, or in the Netter's Anatomy Atlas for iPad app—Dr. Netter's paintings of the intricacies of the human form remain as relevant today as at first launch. The publication of the 6th edition marks the silver anniversary of the first release of Frank H. Netter's *Atlas of Human Anatomy*—when its vibrant colors and unique clinical perspective made it a must-have companion in anatomy classes, dissection labs, and clinical professional offices worldwide—solidifying his legacy to so many as one of the world's most influential medical educators.

Anatomy remains a cornerstone of healthcare education. It is often one of the first topics taught in medical or healthcare curricula. Anatomy is also central to so much in clinical practice, from physical examination and radiologic imaging to surgery and physical rehabilitation. However, changes in anatomy education and its clinical application over these past 25 years have been significant. Medical and healthcare curricula increasingly integrate anatomy throughout and dedicated gross-anatomy hours have decreased. Some programs have discontinued full-body dissection. Advances in imaging technology have provided increasingly clearer views of living anatomy, and 3D models of anatomy continue to evolve. Likewise, the *Atlas* has evolved. Thanks to the tremendous guidance of leading clinical anatomists and expert anatomy educators, as well as the contributions of talented medical illustrators, the 6th edition features newly created illustrations and modern radiologic images that provide students with views of current clinical significance and perspectives that elucidate complex anatomic relationships. This edition also includes the illustrations from older editions of the *Atlas*, like Dr. Netter's depictions of common anatomic variations (in electronic editions and print+electronic packages) as bonus plates to help provide more comprehensive coverage that dissection lab hours may not allow. For the first time, the *Atlas* incorporates muscle tables as quick look-up appendices at the end of each section for the convenience of the clinician, student, or educator with little time. StudentConsult.com and NetterReference.com electronic resources include some 3D models extracted from Netter's 3D Interactive Anatomy, dissection video selections from Netter's Online Dissection Modules by UNC at Chapel Hill, and other supporting resources. In addition, all text throughout the Atlas has been meticulously updated to be in line with the most recent version of *Terminologia Anatomica* by the Federal International Program for Anatomical Terminology (FIPAT) of the International Federation of Associations of Anatomists (IFAA).

The unique visual perspective of Frank H. Netter is unsurpassed. Dr. Netter brought the hand of a master medical illustrator, the brain of a physician, and the soul of an artist to his depictions of the human body. This 25th anniversary edition celebrates the lasting impact of his work that continues to teach and inspire.

We want to hear from you—about the history and future of anatomy education and medicine and the Netter legacy and invite you to share your thoughts, inspirations, memories, tributes, and feedback with us through email: NetterAppFeedback@elsevier.com and on Facebook: www.facebook.com/NetterImages







Frank H. Netter, MD
Photograph by James L. Clayton

To my dear wife, Vera

Preface to the First Edition

I have often said that my career as a medical artist for almost 50 years has been a sort of "command performance" in the sense that it has grown in response to the desires and requests of the medical profession. Over these many years, I have produced almost 4,000 illustrations, mostly for *The CIBA* (now *Netter*) *Collection of Medical Illustrations* but also for *Clinical Symposia.* These pictures have been concerned with the varied subdivisions of medical knowledge such as gross anatomy, histology, embryology, physiology, pathology, diagnostic modalities, surgical and therapeutic techniques, and clinical manifestations of a multitude of diseases. As the years went by, however, there were more and more requests from physicians and students for me to produce an atlas purely of gross anatomy. Thus, this atlas has come about, not through any inspiration on my part but rather, like most of my previous works, as a fulfillment of the desires of the medical profession.

It involved going back over all the illustrations I had made over so many years, selecting those pertinent to gross anatomy, classifying them and organizing them by system and region, adapting them to page size and space, and arranging them in logical sequence. Anatomy of course does not change, but our understanding of anatomy and its clinical significance does change, as do anatomical terminology and nomenclature. This therefore required much updating of many of the older pictures and even revision of a number of them in order to make them more pertinent to today's ever-expanding scope of medical and surgical practice. In addition, I found that there were gaps in the portrayal of medical knowledge as pictorialized in the illustrations I had previously done, and this necessitated my making a number of new pictures that are included in this volume.

In creating an atlas such as this, it is important to achieve a happy medium between complexity and simplification. If the pictures are too complex, they may be difficult and confusing to read; if oversimplified, they may not be adequately definitive or may even be misleading. I have therefore striven for a middle course of realism without the clutter of confusing minutiae. I hope that the students and members of the medical and allied professions will find the illustrations readily understandable, yet instructive and useful.

At one point, the publisher and I thought it might be nice to include a foreword by a truly outstanding and renowned anatomist, but there are so many in that category that we could not make a choice. We did think of men like Vesalius, Leonardo da Vinci, William Hunter, and Henry Gray, who of course are unfortunately unavailable, but I do wonder what their comments might have been about this atlas.

Frank H. Netter, MD
(1906–1991)

Frank H. Netter, MD

Frank H. Netter was born in New York City in 1906. He studied art at the Art Students League and the National Academy of Design before entering medical school at New York University, where he received his Doctor of Medicine degree in 1931. During his student years, Dr. Netter's notebook sketches attracted the attention of the medical faculty and other physicians, allowing him to augment his income by illustrating articles and textbooks. He continued illustrating as a sideline after establishing a surgical practice in 1933, but he ultimately opted to give up his practice in favor of a full-time commitment to art. After service in the United States Army during World War II, Dr. Netter began his long collaboration with the CIBA Pharmaceutical Company (now Novartis Pharmaceuticals). This 45-year partnership resulted in the production of the extraordinary collection of medical art so familiar to physicians and other medical professionals worldwide.

Icon Learning Systems acquired the Netter Collection in July 2000 and continued to update Dr. Netter's original paintings and to add newly commissioned paintings by artists trained in the style of Dr. Netter. In 2005, Elsevier Inc. purchased the Netter Collection and all publications from Icon Learning Systems. There are now over 50 publications featuring the art of Dr. Netter available through Elsevier Inc.

Dr. Netter's works are among the finest examples of the use of illustration in the teaching of medical concepts. The 13-book *Netter Collection of Medical Illustrations,* which includes the greater part of the more than 20,000 paintings created by Dr. Netter, became and remains one of the most famous medical works ever published. *The Netter Atlas of Human Anatomy,* first published in 1989, presents the anatomic paintings from the Netter Collection. Now translated into 16 languages, it is the anatomy atlas of choice among medical and health professions students the world over.

The Netter illustrations are appreciated not only for their aesthetic qualities, but, more importantly, for their intellectual content. As Dr. Netter wrote in 1949 "clarification of a subject is the aim and goal of illustration. No matter how beautifully painted, how delicately and subtly rendered a subject may be, it is of little value as a *medical illustration* if it does not serve to make clear some medical point." Dr. Netter's planning, conception, point of view, and approach are what inform his paintings and what make them so intellectually valuable.

Frank H. Netter, MD, physician and artist, died in 1991.

Acknowledgments

Brion Benninger, MD, MS

I would like to thank my wife, Alison, and our son, Jack, for their wit, caring, and the love they provide me daily. I want to thank Elsevier, especially Marybeth Thiel, for her insight and direction, enabling John Hansen, my fellow coeditors, and Carlos Machado to work in such a rich environment. I particularly want to thank my early clinical anatomy mentors, Gerald Tressidor and Harold Ellis (Guy's Hospital); Dean P. Crone and the University Board for continuous support; all my past and future patients and students; and clinical colleagues who keep anatomy dynamic. Special thanks to Jim McDaniel and Bill Bryan and all who represent what is good in teaching. Lastly, I thank my mother for her love of education and my father for his inquisitive mind.

Jennifer Brueckner-Collins, PhD

I am very grateful to the wonderful Elsevier team, particularly Marybeth Thiel and Elyse O'Grady, for their guidance and expertise during our preparation of the sixth edition. It is always privilege to collaborate with Carlos Machado, whose artistic talent brings our anatomical visions from concept to reality. Sincere thanks to Mark Sturgill, DO, who most generously provided us with updated images for abdominal MRCP, axial and coronal CT with contrast, as well as CT angiography. Finally, I am eternally indebted to my parents, John and Rheba, and to my husband, Kurt, for their support, encouragement, love, and inspiration; they are my raison d'etre.

John T. Hansen, PhD

At Elsevier I would like to thank Marybeth Thiel, Senior Development Editor, Elyse O'Grady, Senior Content Strategist, John Casey, Senior Project Manager, and Madelene Hyde, Publishing Director, for their continuous support and meticulous attention to detail during the development of this sixth edition of the *Atlas of Human Anatomy.* They, along with the entire Editorial, Production, Design, and Marketing team at Elsevier have been a delight to work with and to know. I am also indebted to Carlos Machado for his superb artistic skill in producing and updating plates appearing in the *Atlas*. His renderings of human anatomy are the perfect complement to the Netter images. In addition to my fellow editors of this edition, I wish to express my thanks to my faculty colleagues at Rochester and to all my past and present students who have provided generous and constructive feedback and have enriched my life. Finally, I am indebted to my entire family for their continued support and especially to my wife, Paula. Their love and encouragement sustains me and is the source of all the happiness and joy I know.

Todd M. Hoagland, PhD

It is a privilege to teach clinical human anatomy and I am eternally grateful to all the body donors and their families for enabling healthcare professionals to train in the dissection laboratory. It is my honor to work with outstanding medical students and colleagues at the Medical College of Wisconsin. I am grateful to John Hansen and the professionals of the Elsevier team for the opportunity to be a steward of the incomparable *Netter Atlas*. Marybeth Thiel and Elyse O'Grady were especially helpful and a pleasure to work with. It was an honor to collaborate with the brilliant Carlos Machado and all the consulting editors. I thank Joe Besharse for being an outstanding mentor. I am deeply appreciative of Stan Hillman and Jack O'Malley for inspiring me with masterful teaching and rigorous expectations. I am indebted to Richard Hoyt, Jr., for helping me become a competent anatomist, and to Rob Bouchie for his support. I am most grateful to my brother, Bill, for his unwavering optimism and gregarious nature. I thank my mother, Liz, for her dedication and love and for instilling a strong work ethic. Finally, I am humbled by my two awesome children, Ella and Caleb, for helping me redefine love, wonder, and joy.

R. Shane Tubbs, MS, PA-C, PhD

First and foremost, I would like to thank Elsevier and in particular, Madelene Hyde, Marybeth Thiel, and Elyse O'Grady for all of their hard work in making this edition come to life. The evolution of the current atlas continues with the superb skills of Dr. Carlos Machado and his works of art. I would like to thank Dr. Satinder Singh for his kind assistance in providing radiographic images of the heart. I thank my beautiful wife, Susan, and son, Isaiah, for their patience and guidance during the editing of the sixth edition. Without the continued support of my mentor, friend, and colleague, Dr. W. Jerry Oakes, I could not fulfill all of my academic endeavors. I dedicate my efforts in this edition to my late brother-in-law, Nelson Jones, whose appetite for inquisitiveness inspires me today.

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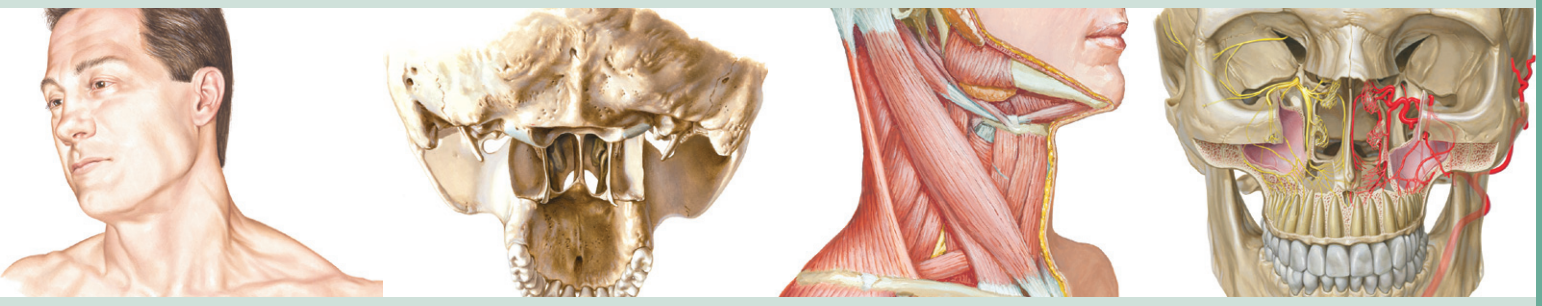
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Section

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33 Nerves and Vessels of Neck (continued)
34 Carotid Arteries

Nasal Region

Plates 35–55

35 Nose
36 Lateral Wall of Nasal Cavity
37 Lateral Wall of Nasal Cavity (continued)
38 Medial Wall of Nasal Cavity (Nasal Septum)
39 Nerves of Nasal Cavity
40 Arteries of Nasal Cavity: Nasal Septum Turned Up
41 Nerves of Nasal Cavity: Nasal Septum Turned Up
42 Nose and Maxillary Sinus: Transverse Section
43 Paranasal Sinuses
44 Paranasal Sinuses (continued)
45 Paranasal Sinuses: Changes with Age
46 Salivary Glands
47 Tongue and Salivary Glands: Sections
48 Muscles Involved in Mastication
49 Muscles Involved in Mastication (continued)
50 Mandibular Nerve (V_3)
51 Maxillary Artery
52 Ophthalmic (V_1) and Maxillary (V_2) Nerves
53 Autonomic Innervation of Nasal Cavity
54 Pterygopalatine Fossa
55 Orientation of Nerves and Vessels of the Cranial Base

Oral Region

Plates 56–63

56 Inspection of Oral Cavity
57 Roof of Oral Cavity
58 Floor of Oral Cavity
59 Tongue
60 Tongue (continued)
61 Afferent Innervation of Oral Cavity and Pharynx
62 Teeth
63 Teeth (continued)

Pharynx

Plates 64–75

64 Pharynx: Median Section
65 Muscles of Pharynx: Sagittal Section
66 Pharynx: Opened Posterior View
67 Muscles of Pharynx: Partially Opened Posterior View
68 Fauces
69 Pharyngoesophageal Junction
70 Muscles of Pharynx: Lateral View
71 Nerves of Oral and Pharyngeal Regions
72 Arteries of Oral and Pharyngeal Regions
73 Veins of Oral and Pharyngeal Regions
74 Lymph Vessels and Nodes of Head and Neck
75 Lymph Vessels and Nodes of Pharynx and Tongue

Thyroid Gland and Larynx

Plates 76–82

76 Thyroid Gland: Anterior View
77 Thyroid Gland and Pharynx: Posterior View
78 Parathyroid Glands
79 Cartilages of Larynx
80 Intrinsic Muscles of Larynx
81 Action of Intrinsic Muscles of Larynx
82 Nerves of Larynx

Orbit and Contents

Plates 83–93

83 Eyelids
84 Lacrimal Apparatus
85 Fasciae of Orbit and Eyeball
86 Extrinsic Eye Muscles
87 Arteries and Veins of Orbit and Eyelids
88 Nerves of Orbit
89 Eyeball
90 Anterior and Posterior Chambers of Eye
91 Lens and Supporting Structures
92 Intrinsic Arteries and Veins of Eye
93 Vascular Supply of Eye

Ear

Plates 94–100

94 Pathway of Sound Reception
95 External Ear and Tympanic Cavity
96 Tympanic Cavity
97 Bony and Membranous Labyrinths
98 Bony and Membranous Labyrinths (continued)
99 Orientation of Labyrinths in Skull
100 Pharyngotympanic (Auditory, Eustachian) Tube

Meninges and Brain

Plates 101–116

101 Meninges and Diploic Veins
102 Meningeal Arteries
103 Meninges and Superficial Cerebral Veins
104 Dural Venous Sinuses
105 Dural Venous Sinuses (continued)
106 Cerebrum: Lateral Views
107 Cerebrum: Medial Views
108 Cerebrum: Inferior View
109 Ventricles of Brain
110 Circulation of Cerebrospinal Fluid
111 Basal Nuclei (Ganglia)
112 Thalamus
113 Hippocampus and Fornix
114 Cerebellum
115 Brainstem
116 Fourth Ventricle and Cerebellum

Cranial and Cervical Nerves

Plates 117–136

117 Cranial Nerve Nuclei in Brainstem: Schema
118 Cranial Nerve Nuclei in Brainstem: Schema (continued)
119 Cranial Nerves (Motor and Sensory Distribution): Schema
120 Olfactory Nerve (I): Schema
121 Optic Nerve (II) (Visual Pathway): Schema
122 Oculomotor (III), Trochlear (IV), and Abducent (VI) Nerves: Schema
123 Trigeminal Nerve (V): Schema
124 Facial Nerve (VII): Schema
125 Vestibulocochlear Nerve (VIII): Schema
126 Glossopharyngeal Nerve (IX): Schema
127 Vagus Nerve (X): Schema
128 Accessory Nerve (XI): Schema
129 Hypoglossal Nerve (XII): Schema
130 Cervical Plexus: Schema
131 Autonomic Nerves in Neck
132 Autonomic Nerves in Head
133 Ciliary Ganglion: Schema
134 Pterygopalatine and Submandibular Ganglia: Schema
135 Otic Ganglion: Schema
136 Taste Pathways: Schema

Cerebral Vasculature

Plates 137–149

137 Arteries to Brain and Meninges

138 Internal Carotid Artery in Petrous Part of Temporal Bone

139 Arteries to Brain: Schema

140 Arteries of Brain: Inferior Views

141 Cerebral Arterial Circle (of Willis)

142 Arteries of Brain: Frontal View and Section

143 Arteries of Brain: Lateral and Medial Views

144 Arteries of Posterior Cranial Fossa

145 Veins of Posterior Cranial Fossa

146 Deep Veins of Brain

147 Subependymal Veins of Brain

148 Hypothalamus and Hypophysis

149 Arteries and Veins of Hypothalamus and Hypophysis

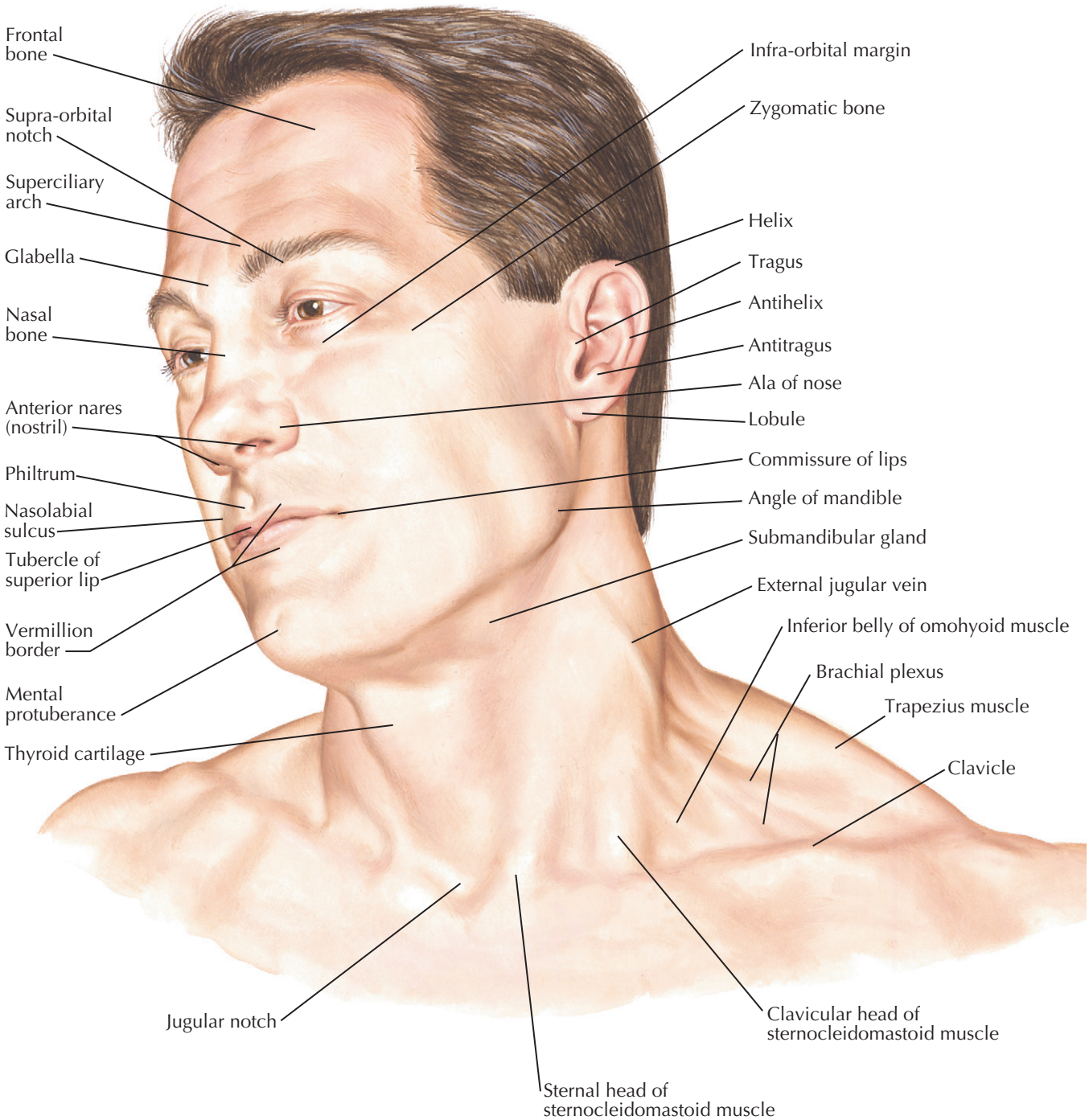
Regional Scans

Plates 150–151

150 Cranial Imaging (MRV and MRA)

151 Cranial Imaging (MRI)

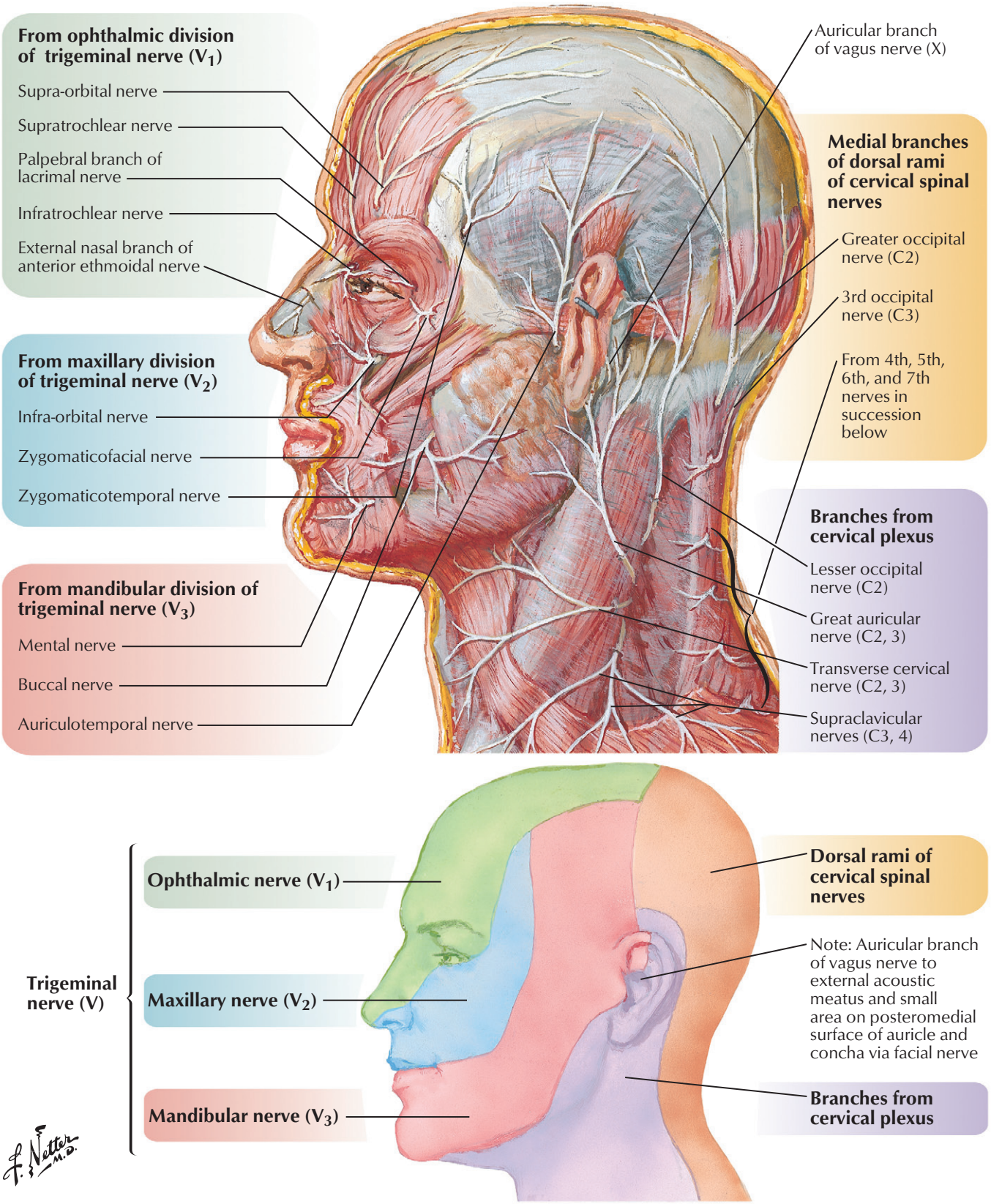
Muscle Tables


Frontal bone
Supra-orbital notch
Superciliary arch
Glabella
Nasal bone
Anterior nares (nostril)
Philtrum
Nasolabial sulcus
Tubercle of superior lip
Vermillion border
Mental protuberance
Thyroid cartilage
Jugular notch
Sternal head of sternocleidomastoid muscle
Clavicular head of sternocleidomastoid muscle
Infra-orbital margin
Zygomatic bone
Helix
Tragus
Antihelix
Antitragus
Ala of nose
Lobule
Commissure of lips
Angle of mandible
Submandibular gland
External jugular vein
Inferior belly of omohyoid muscle
Brachial plexus
Trapezius muscle
Clavicle

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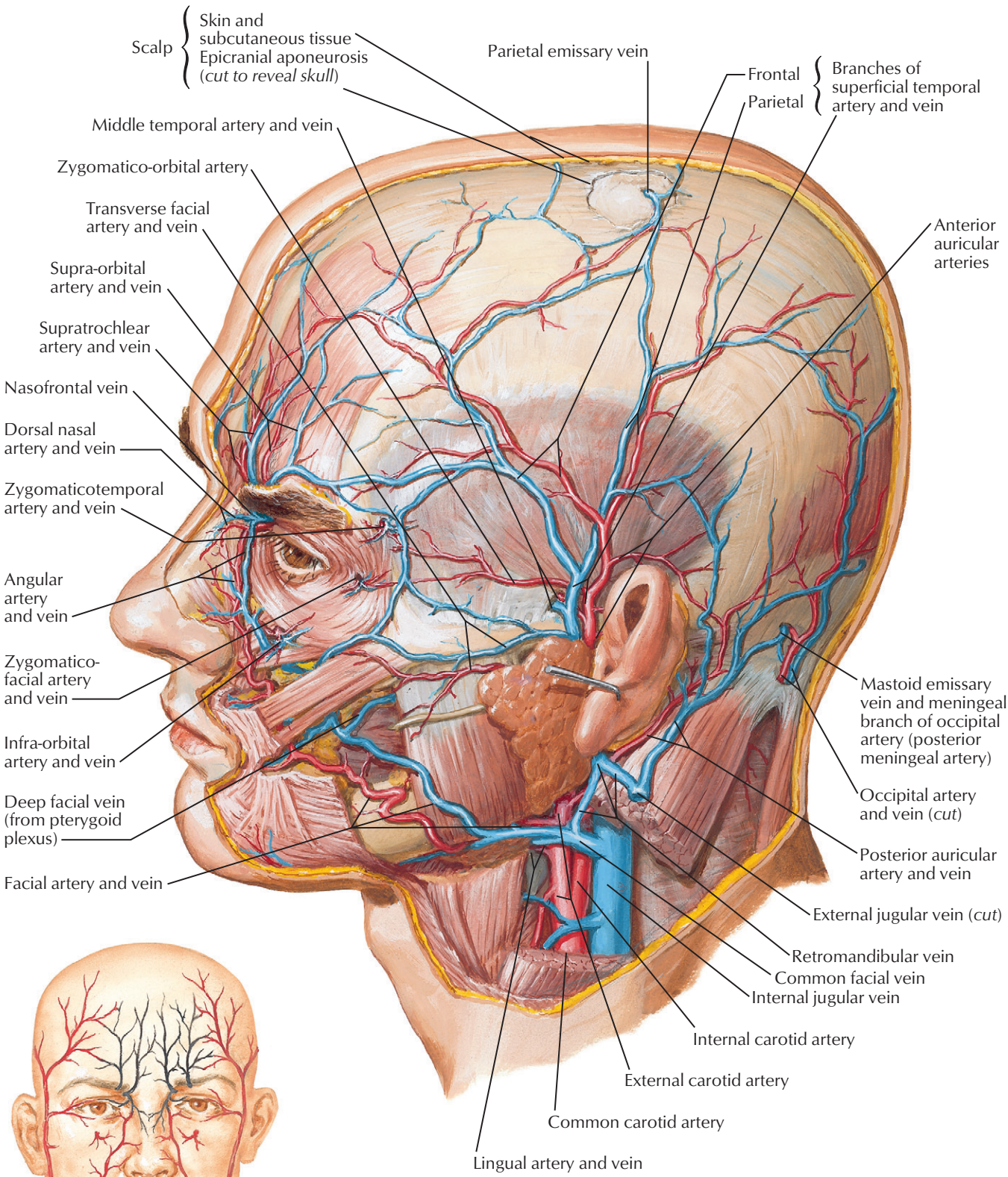
Cutaneous Nerves of Head and Neck

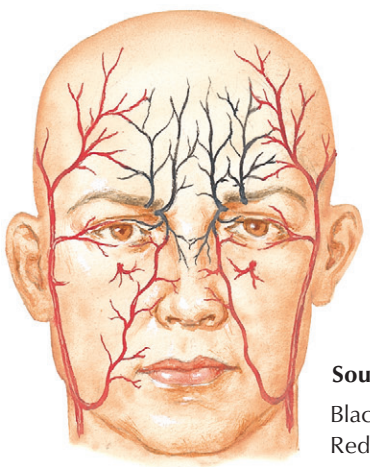
See also Plates 32, 35, 52



Superficial Arteries and Veins of Face and Scalp

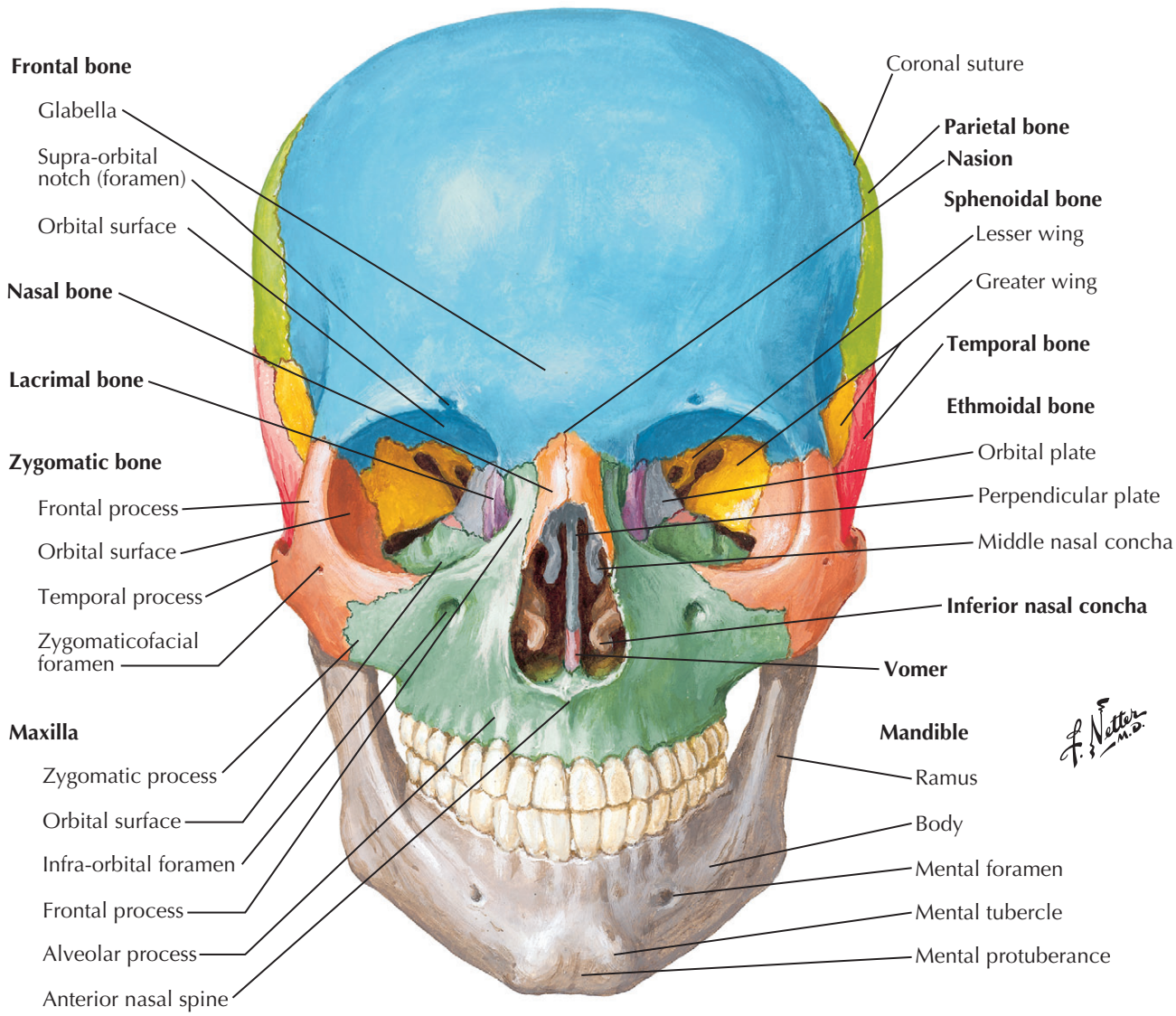
See also **Plates 51, 72, 73**



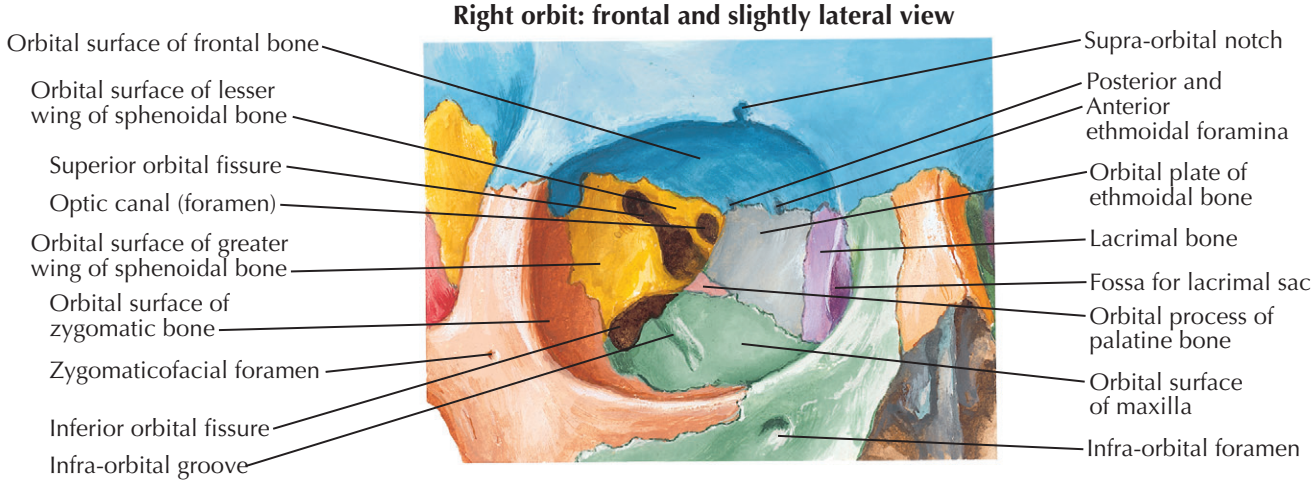


Sources of arterial supply of face

Black: from internal carotid artery (via ophthalmic artery)
Red: from external carotid artery

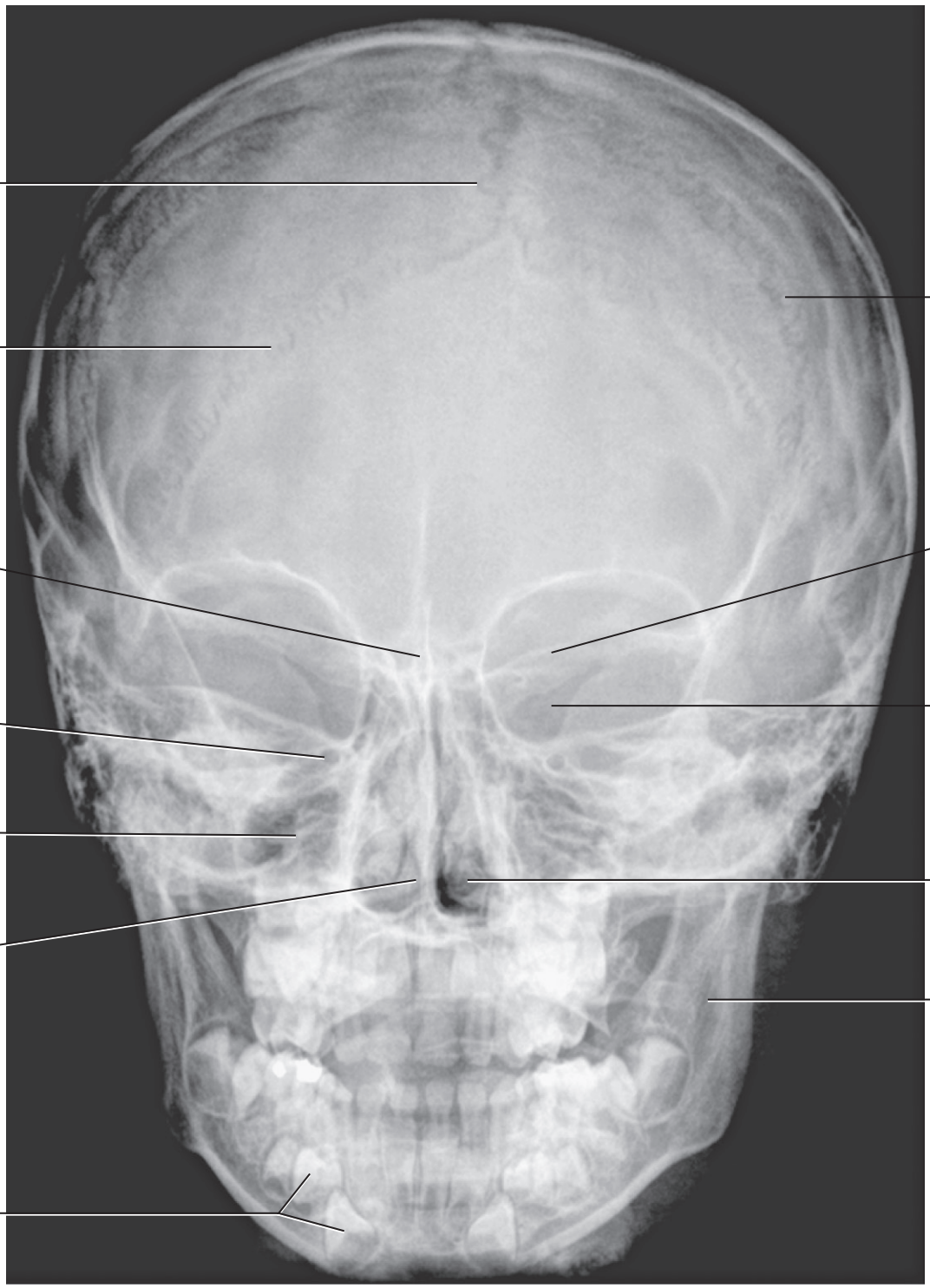


Right orbit: frontal and slightly lateral view



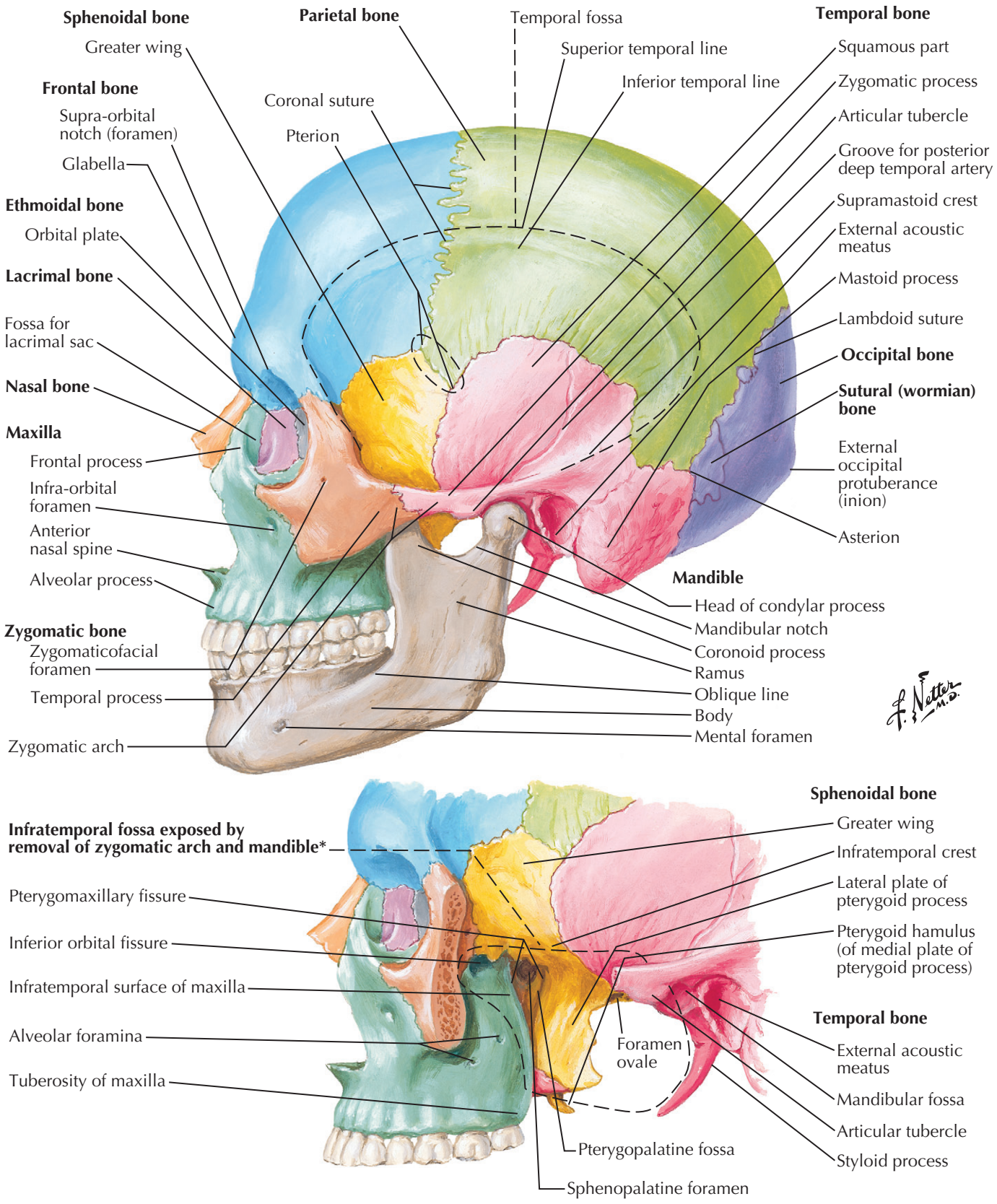
Skull: Anteroposterior Radiograph

See also Plate 4



Skull: Lateral View

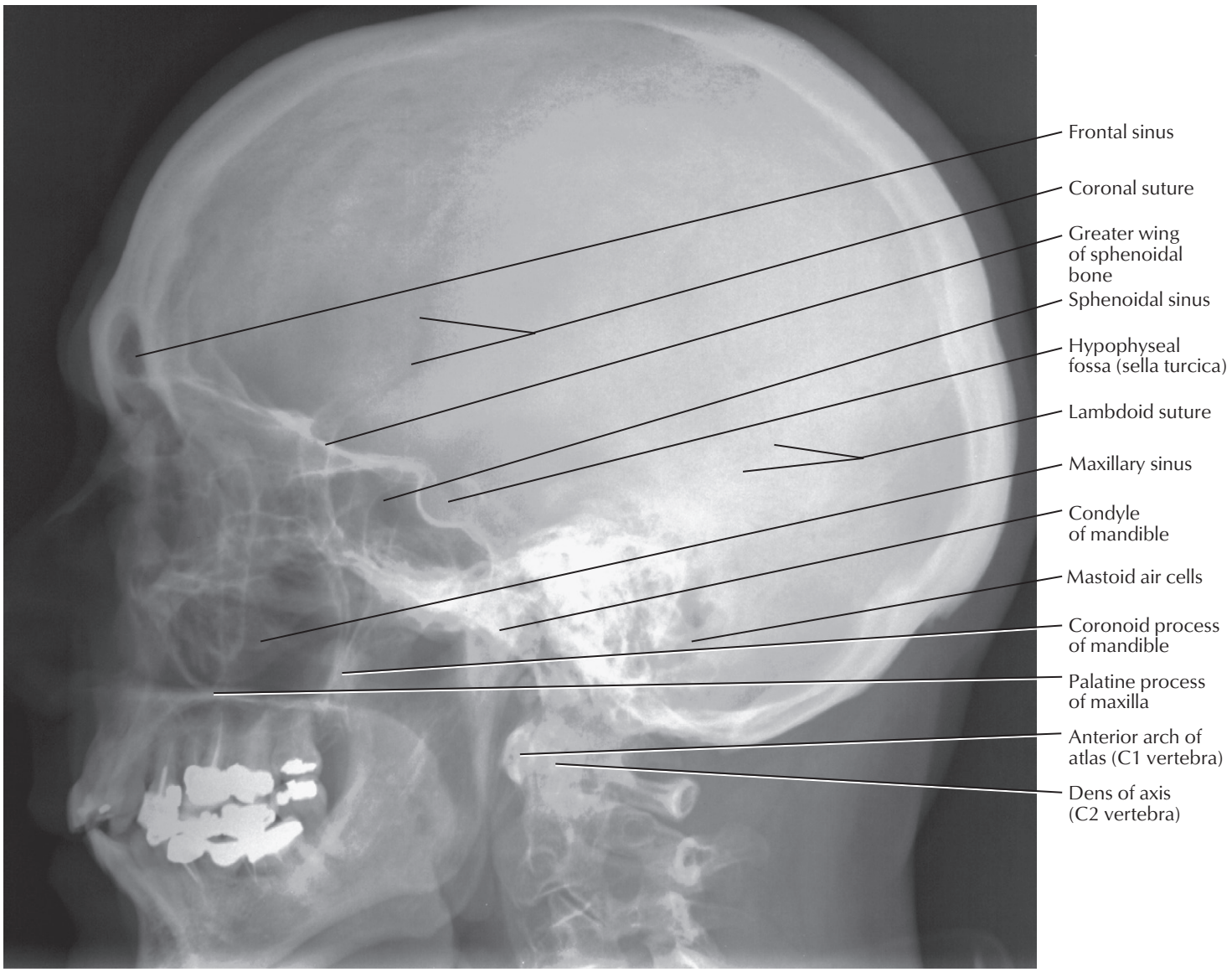
See also Plates 7, 8, 15



Superficially, mastoid process forms posterior boundary.

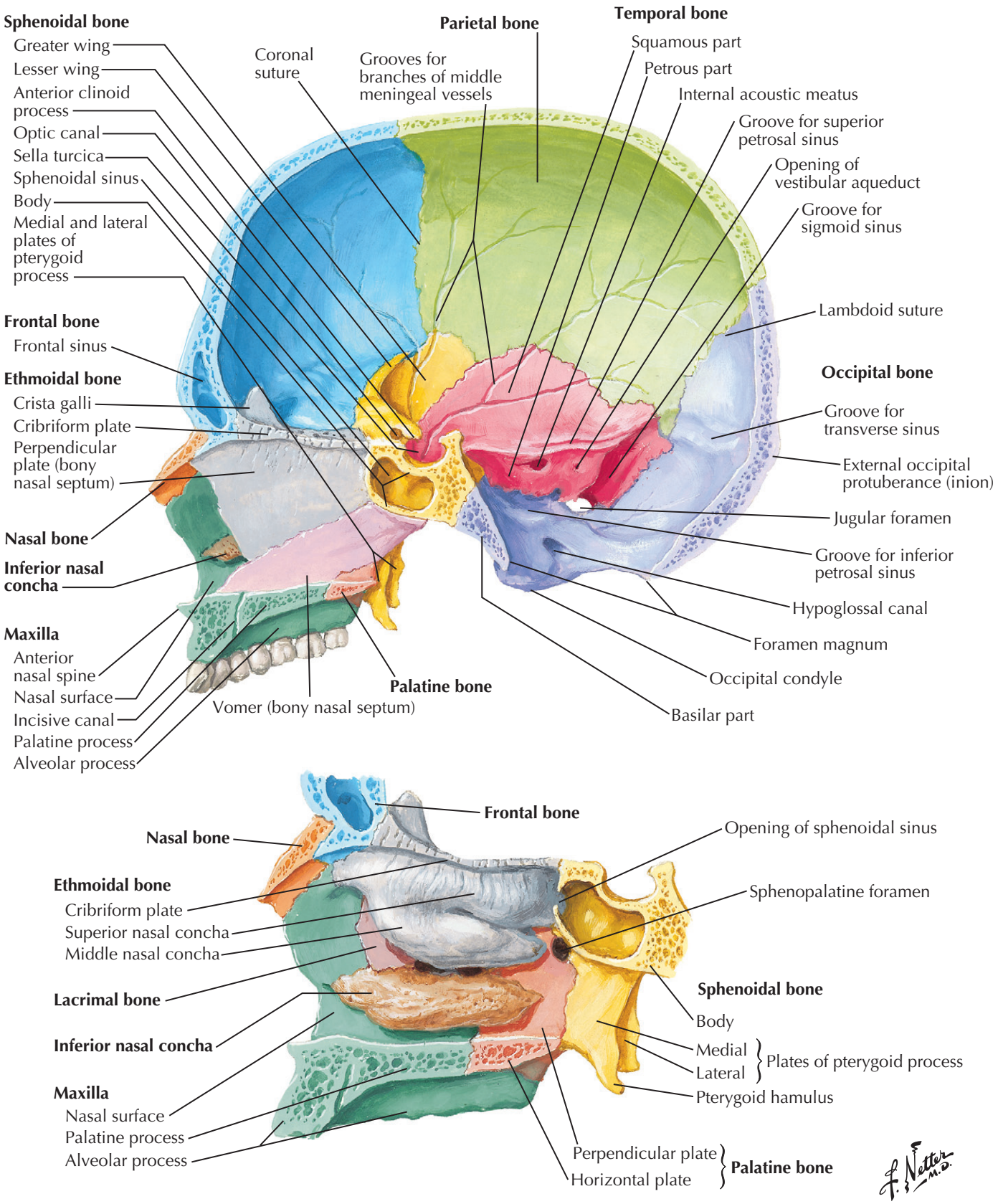
Skull: Lateral Radiograph

See also **Plate 8**



Skull: Midsagittal Section

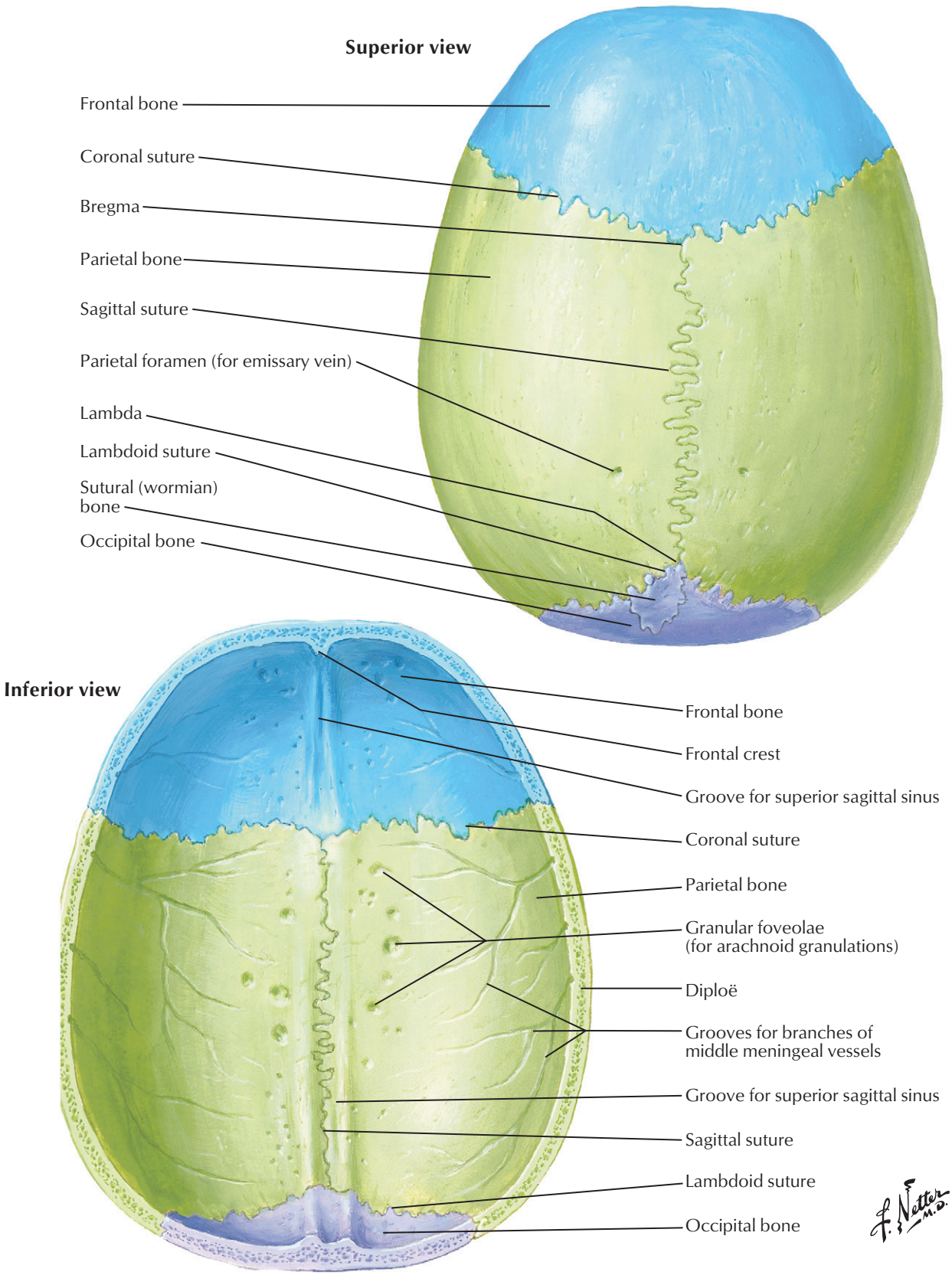
See also Plates 37, 39



View of lateral nasal wall with nasal septum removed

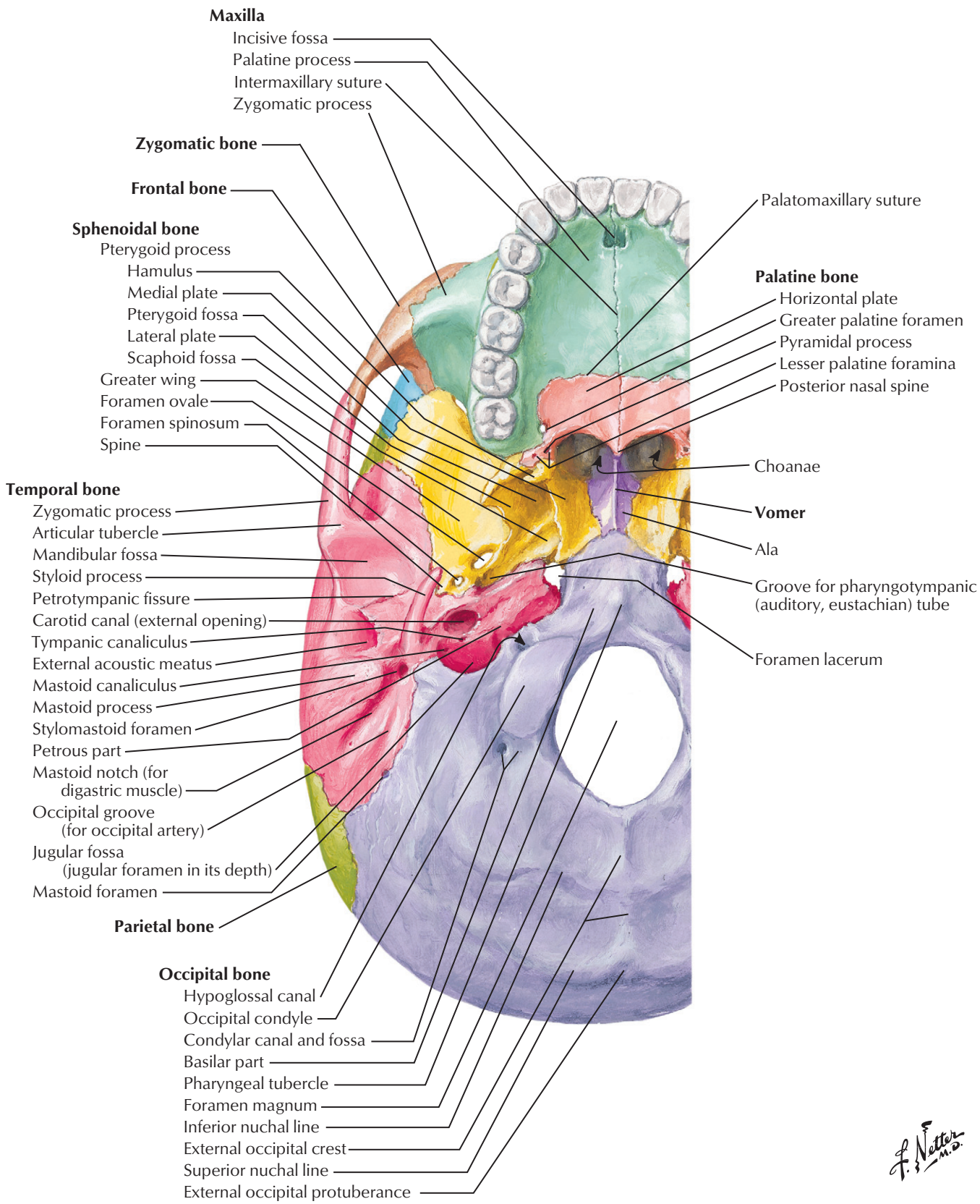
Calvaria

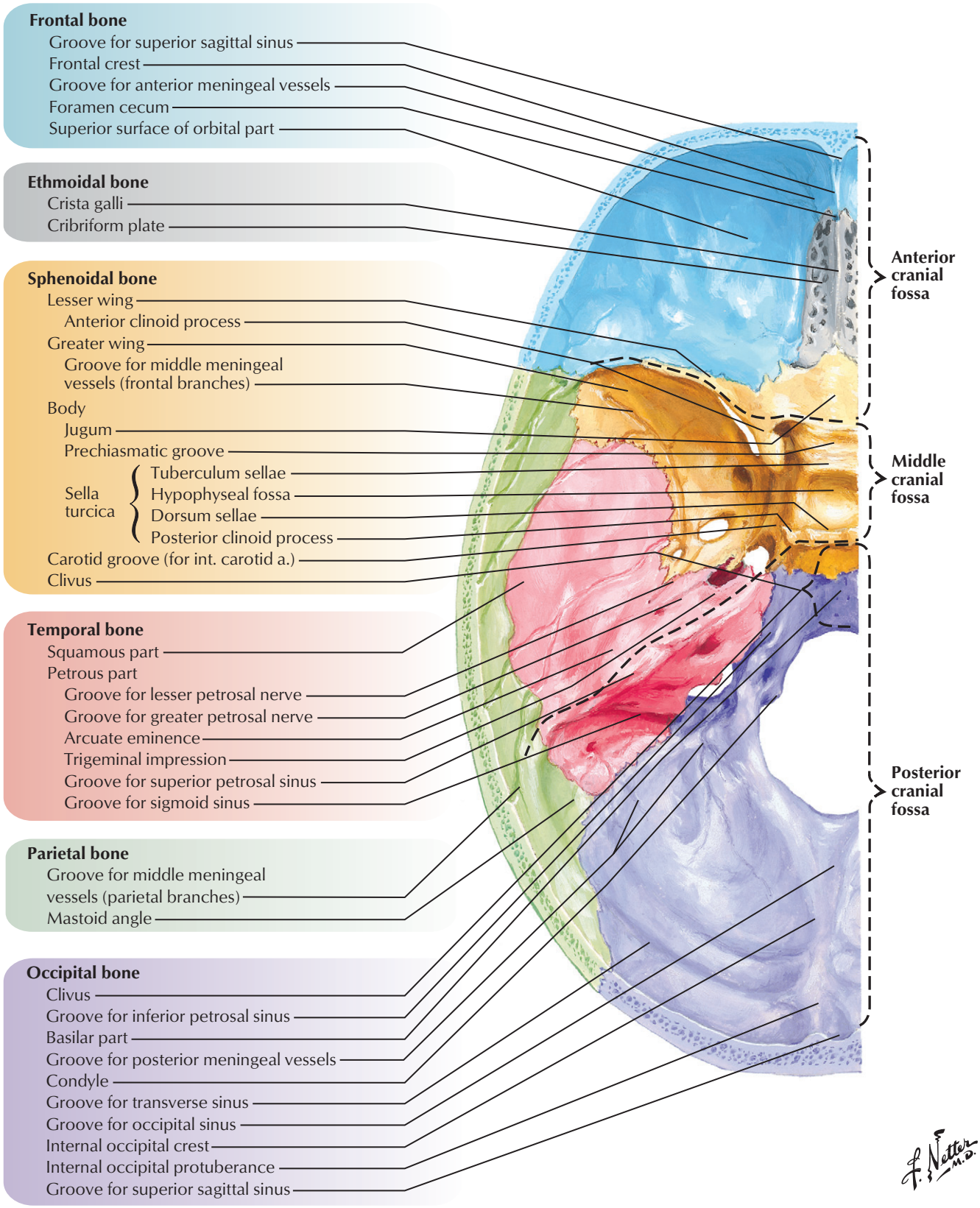
See also Plates 101, 102



Cranial Base: Inferior View

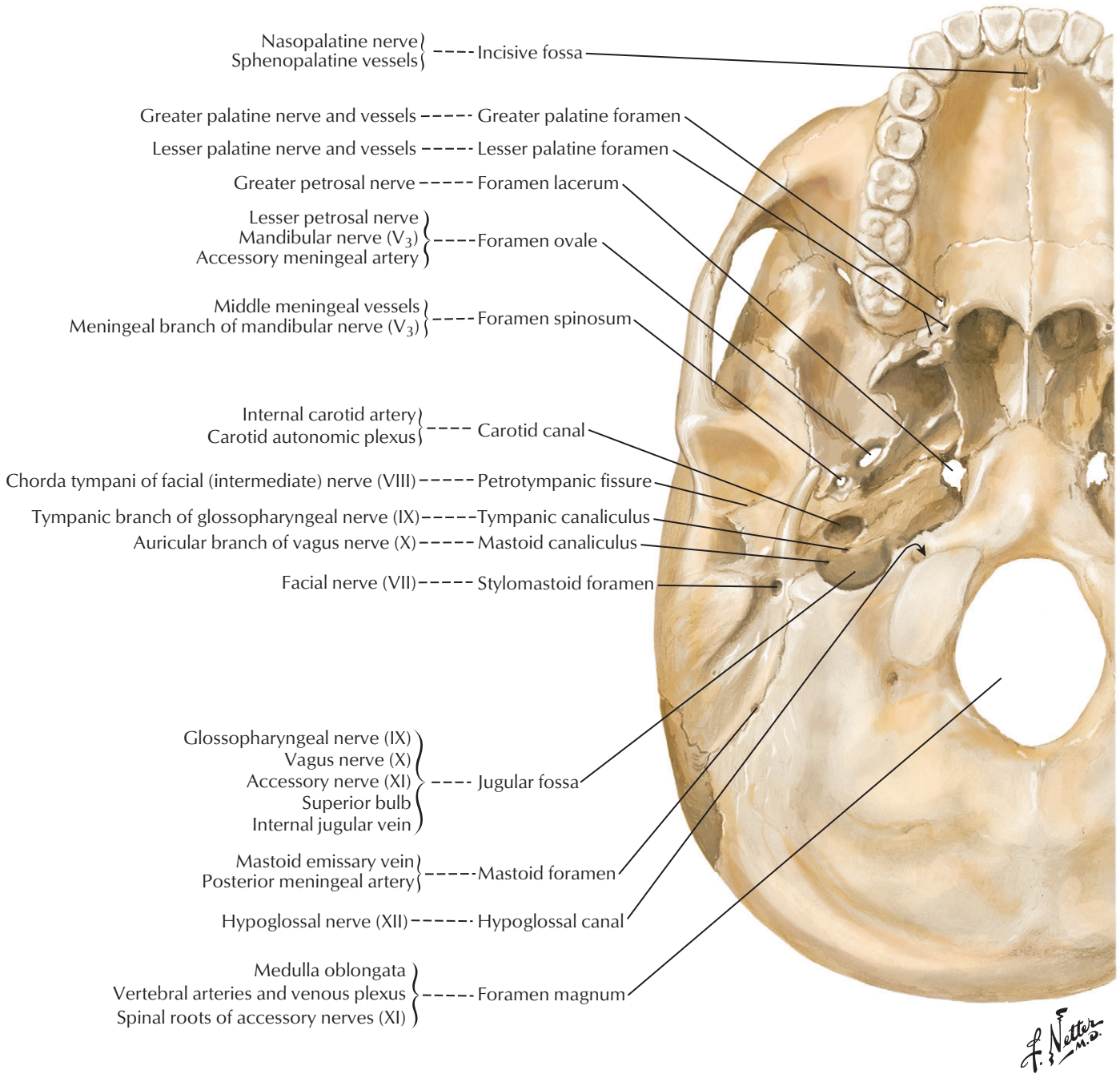
See also Plate 12




Frontal bone
Groove for superior sagittal sinus
Frontal crest
Groove for anterior meningeal vessels
Foramen cecum
Superior surface of orbital part
Ethmoidal bone
Crista galli
Cribriform plate
Sphenoidal bone
Lesser wing
Anterior clinoid process
Greater wing
Groove for middle meningeal vessels (frontal branches)
Body
Jugum
Prechiasmatic groove
Sella turcica
Tuberculum sellae
Hypophyseal fossa
Dorsum sellae
Posterior clinoid process
Carotid groove (for int. carotid a.)
Clivus
Temporal bone
Squamous part
Petrous part
Groove for lesser petrosal nerve
Groove for greater petrosal nerve
Arcuate eminence
Trigeminal impression
Groove for superior petrosal sinus
Groove for sigmoid sinus
Parietal bone
Groove for middle meningeal vessels (parietal branches)
Mastoid angle
Occipital bone
Clivus
Groove for inferior petrosal sinus
Basilar part
Groove for posterior meningeal vessels
Condyle
Groove for transverse sinus
Groove for occipital sinus
Internal occipital crest
Internal occipital protuberance
Groove for superior sagittal sinus
Anterior cranial fossa
Middle cranial fossa
Posterior cranial fossa
F. Netter M.D.

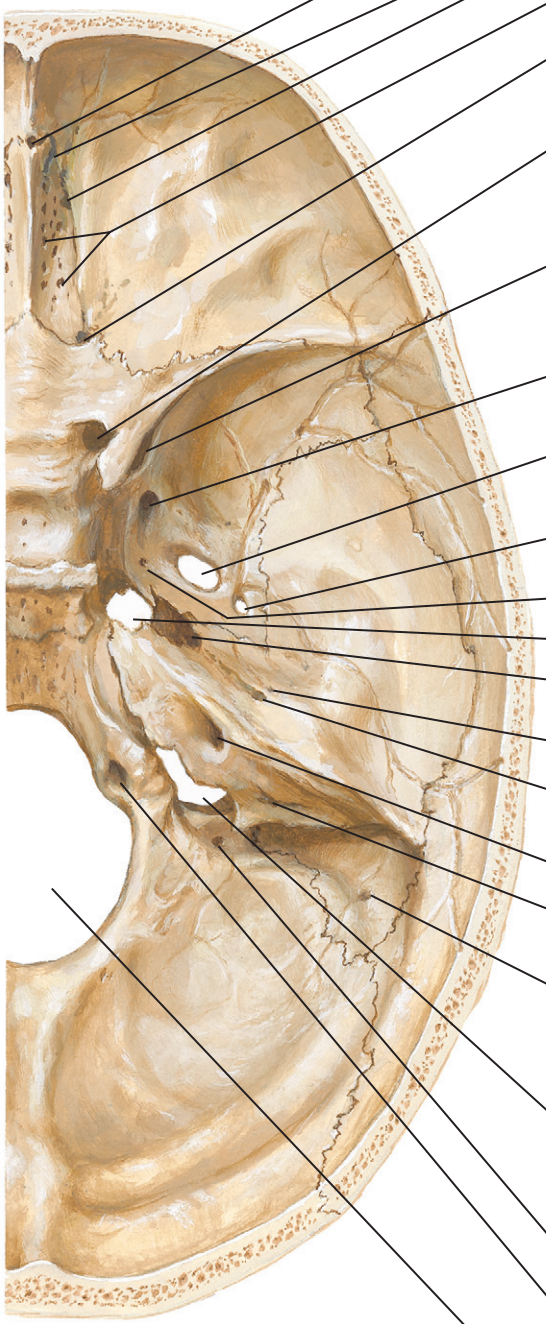
Foramina and Canals of Cranial Base: Inferior View

See also **Plate 10**



Foramina and Canals of Cranial Base: Superior View

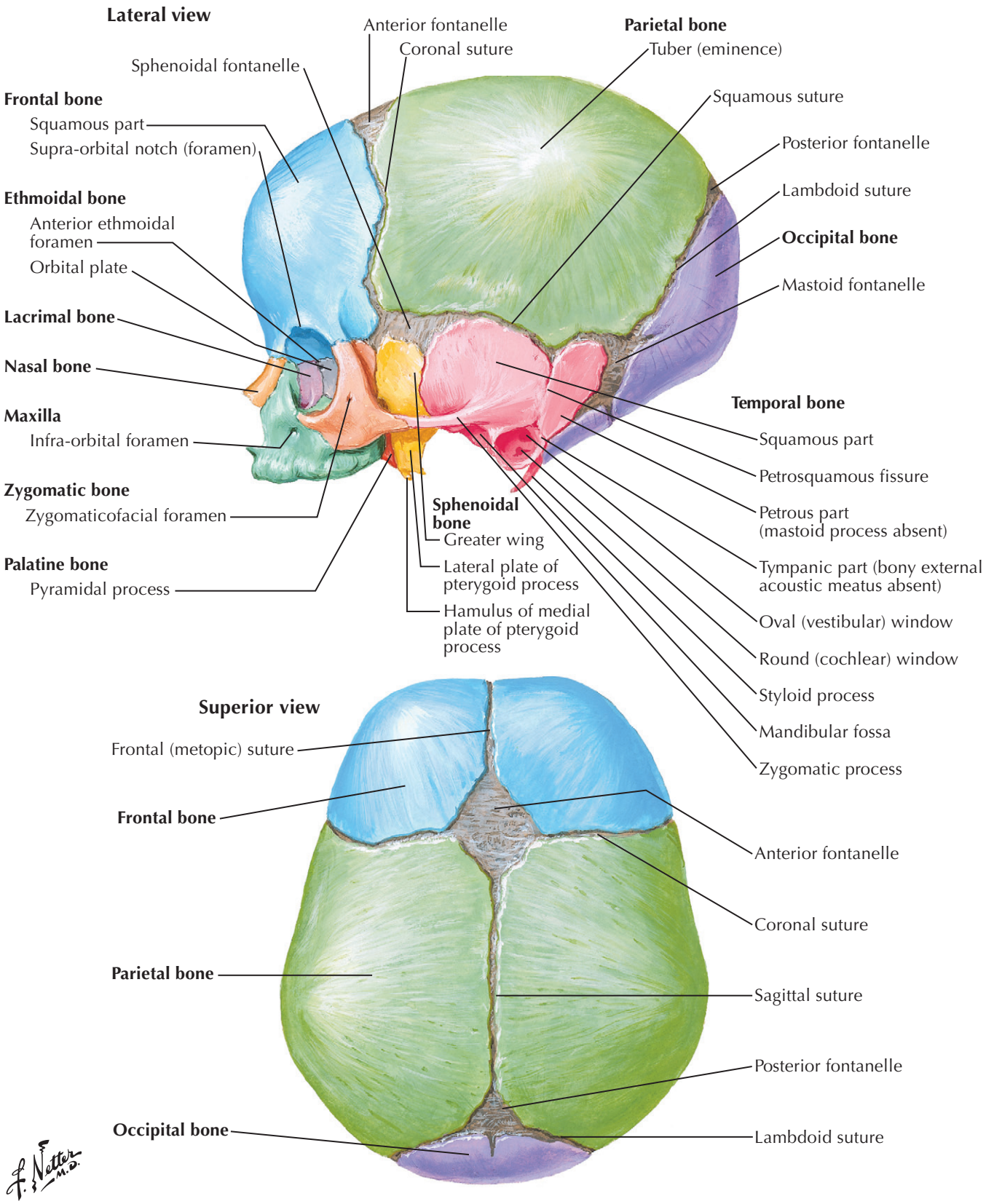
See also Plate 11

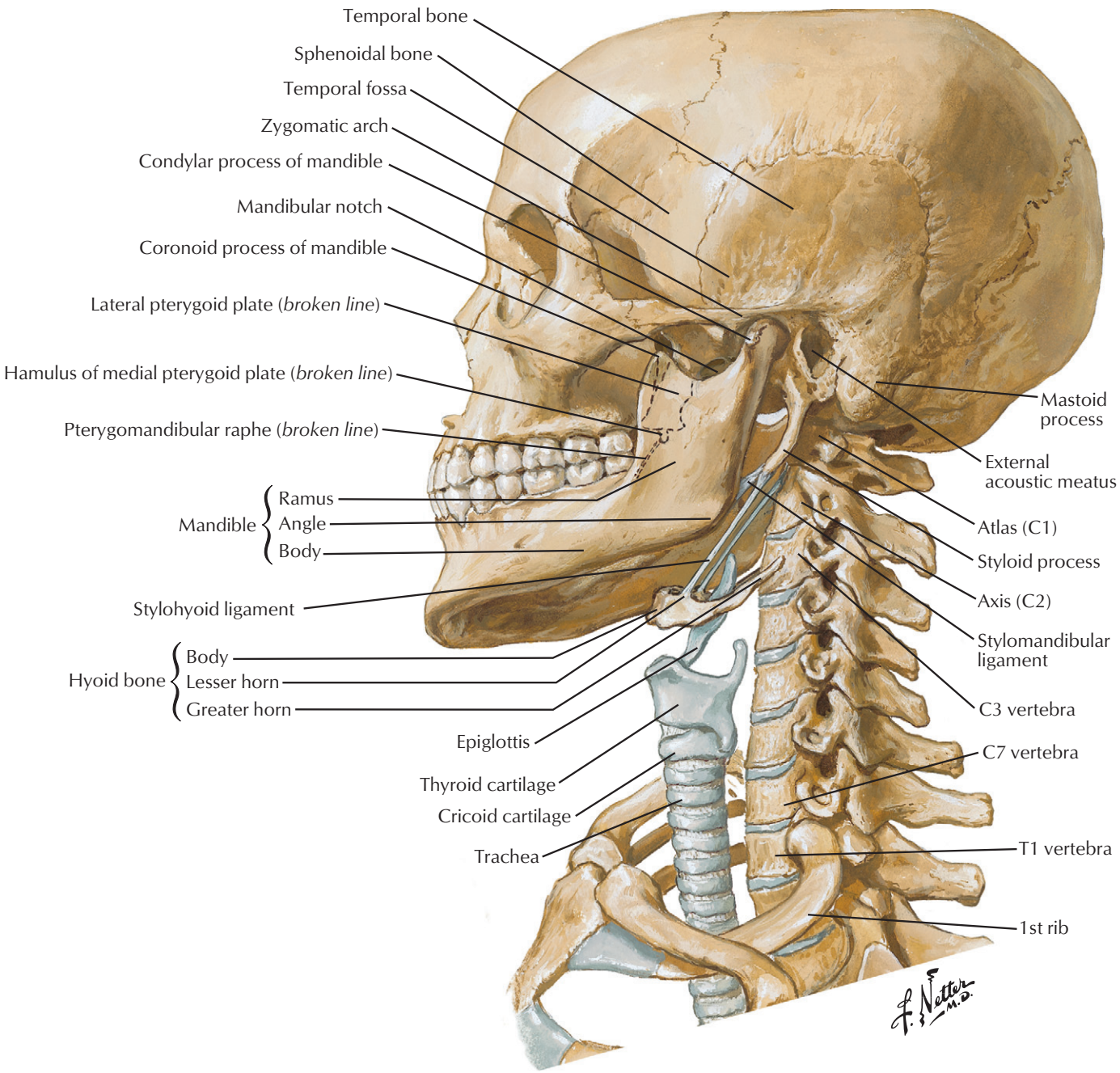


- Foramen cecum — Emissary vein to superior sagittal sinus
- Nasal slit — Anterior ethmoidal artery, vein, and nerve
- Anterior ethmoidal foramen — Anterior ethmoidal artery, vein, and nerve
- Foramina of cribriform plate — Olfactory nerves
- Posterior ethmoidal foramen — Posterior ethmoidal artery, vein, and nerve
- Optic canal — Optic nerve (II); Ophthalmic artery
- Superior orbital fissure — Oculomotor nerve (III); Trochlear nerve (IV); Lacrimal, frontal, and nasociliary branches of ophthalmic nerve (V_1); Abducent nerve (VI); Superior ophthalmic vein
- Foramen rotundum — Maxillary nerve (V_2)
- Foramen ovale — Mandibular nerve (V_3); Accessory meningeal artery; Lesser petrosal nerve
- Foramen spinosum — Middle meningeal artery and vein; Meningeal branch of mandibular nerve
- Sphenoidal emissary foramen (of Vesalius) (inconstant)
- Foramen lacerum — Greater petrosal nerve
- Carotid canal — Internal carotid artery; Internal carotid nerve plexus
- Hiatus for — Lesser petrosal nerve
- Hiatus for — Greater petrosal nerve
- Internal acoustic meatus — Facial nerve (VII); Vestibulocochlear nerve (VIII); Labyrinthine artery
- Opening of vestibular aqueduct — Endolymphatic duct
- Mastoid foramen (inconstant) — Emissary vein (and occasional branch of occipital artery)
- Jugular foramen — Inferior petrosal sinus; Glossopharyngeal nerve (IX); Vagus nerve (X); Accessory nerve (XI); Sigmoid sinus; Posterior meningeal artery
- Condylar canal (inconstant) — Emissary vein and meningeal branch of ascending pharyngeal artery
- Hypoglossal canal — Hypoglossal nerve (XII)
- Foramen magnum — Medulla oblongata; Meninges; Vertebral arteries; Meningeal branches of vertebral arteries; Spinal roots of accessory nerves

Skull of Newborn

See also Plate 6

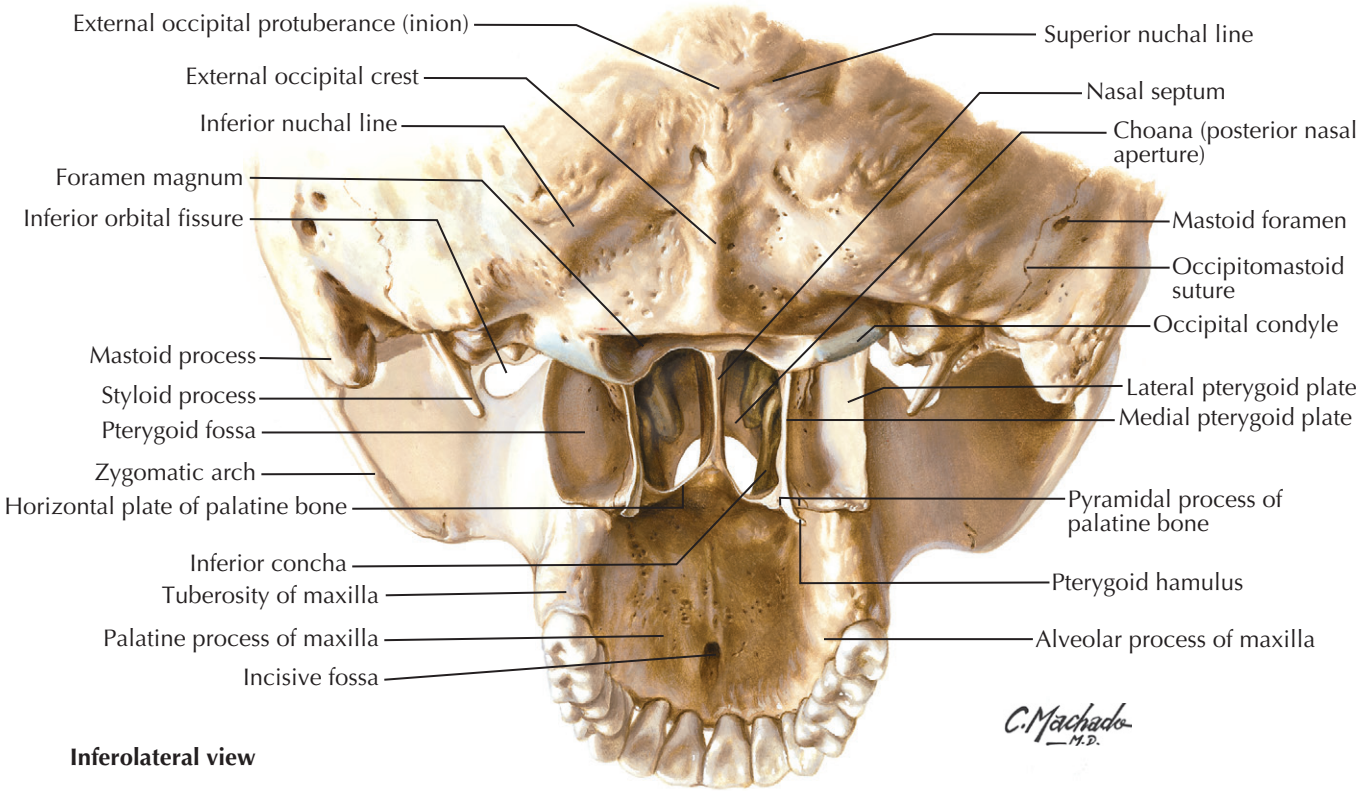



Temporal bone
Sphenoidal bone
Temporal fossa
Zygomatic arch
Condylar process of mandible
Mandibular notch
Coronoid process of mandible
Lateral pterygoid plate (broken line)
Hamulus of medial pterygoid plate (broken line)
Pterygomandibular raphe (broken line)
Mandible
Ramus
Angle
Body
Stylohyoid ligament
Hyoid bone
Body
Lesser horn
Greater horn
Epiglottis
Thyroid cartilage
Cricoid cartilage
Trachea
Mastoid process
External acoustic meatus
Atlas (C1)
Styloid process
Axis (C2)
Stylomandibular ligament
C3 vertebra
C7 vertebra
T1 vertebra
1st rib
F. Netter M.D.

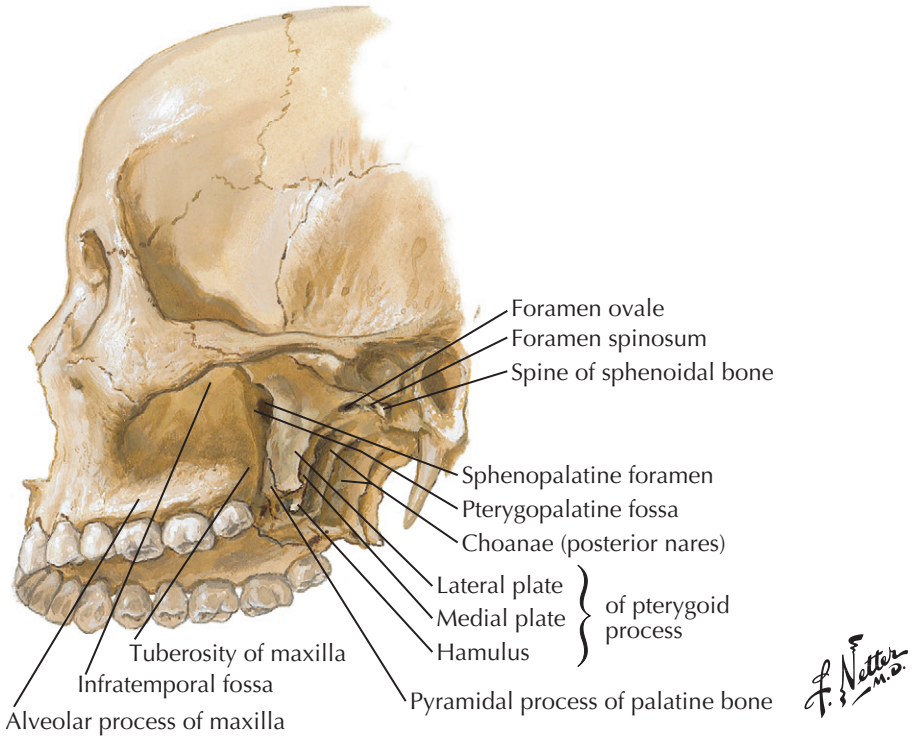
Pterygoid Fossae: Posterior and Inferolateral Views

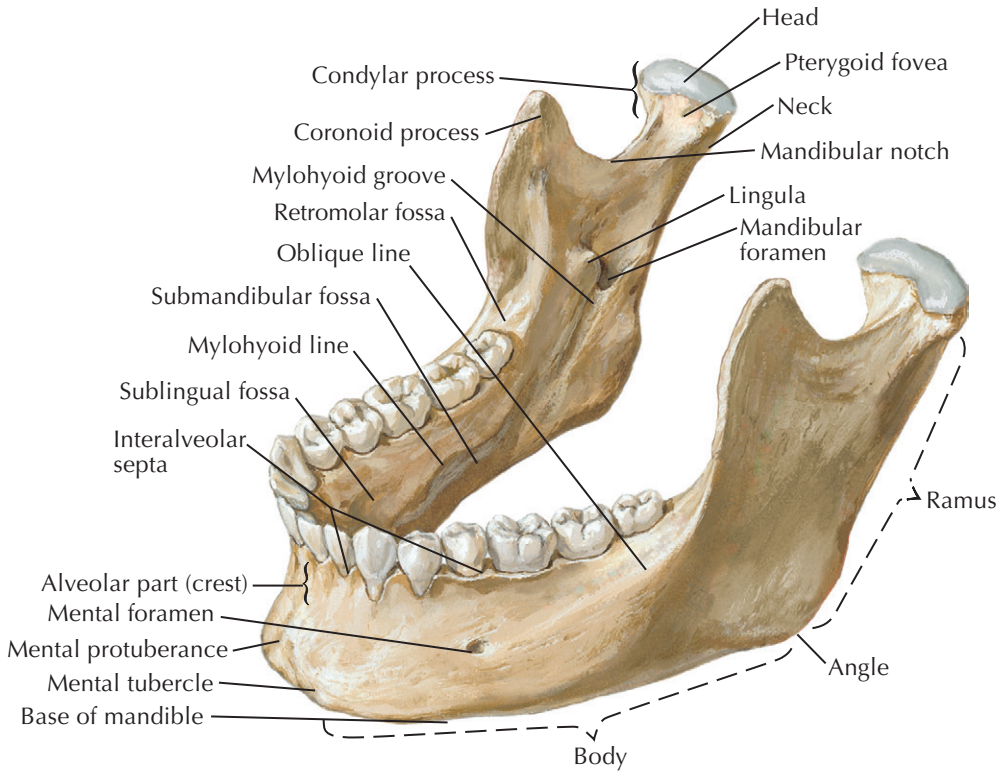
See also Plates 39, 40, 41

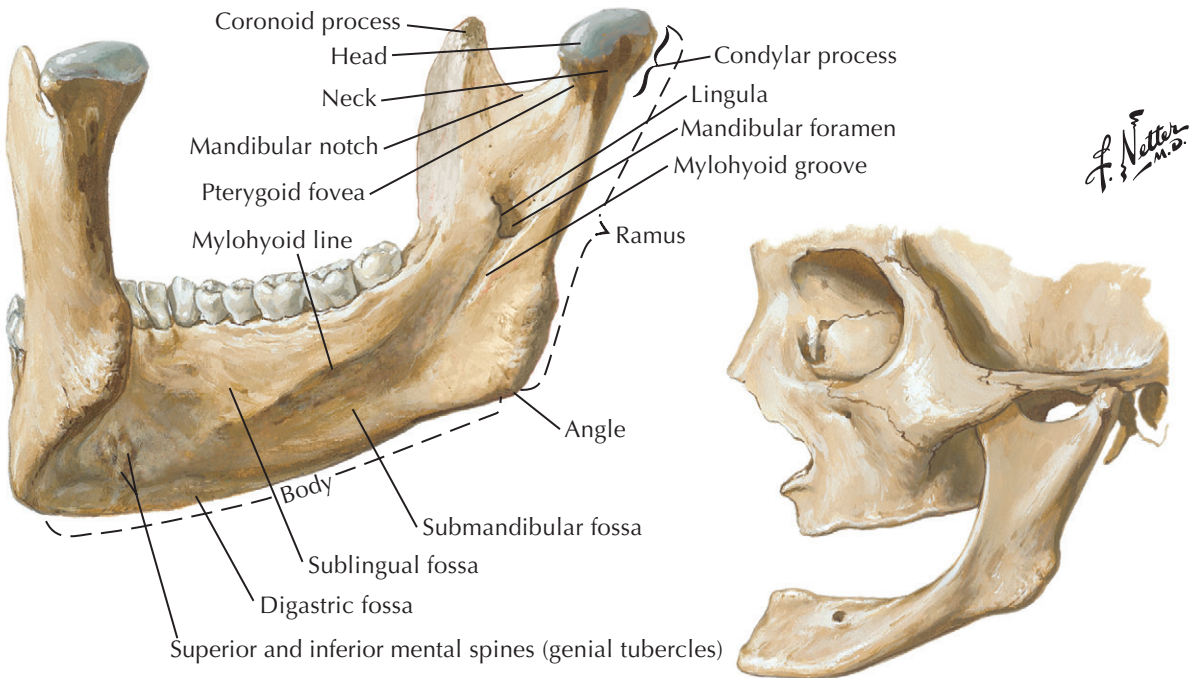
Posterior view



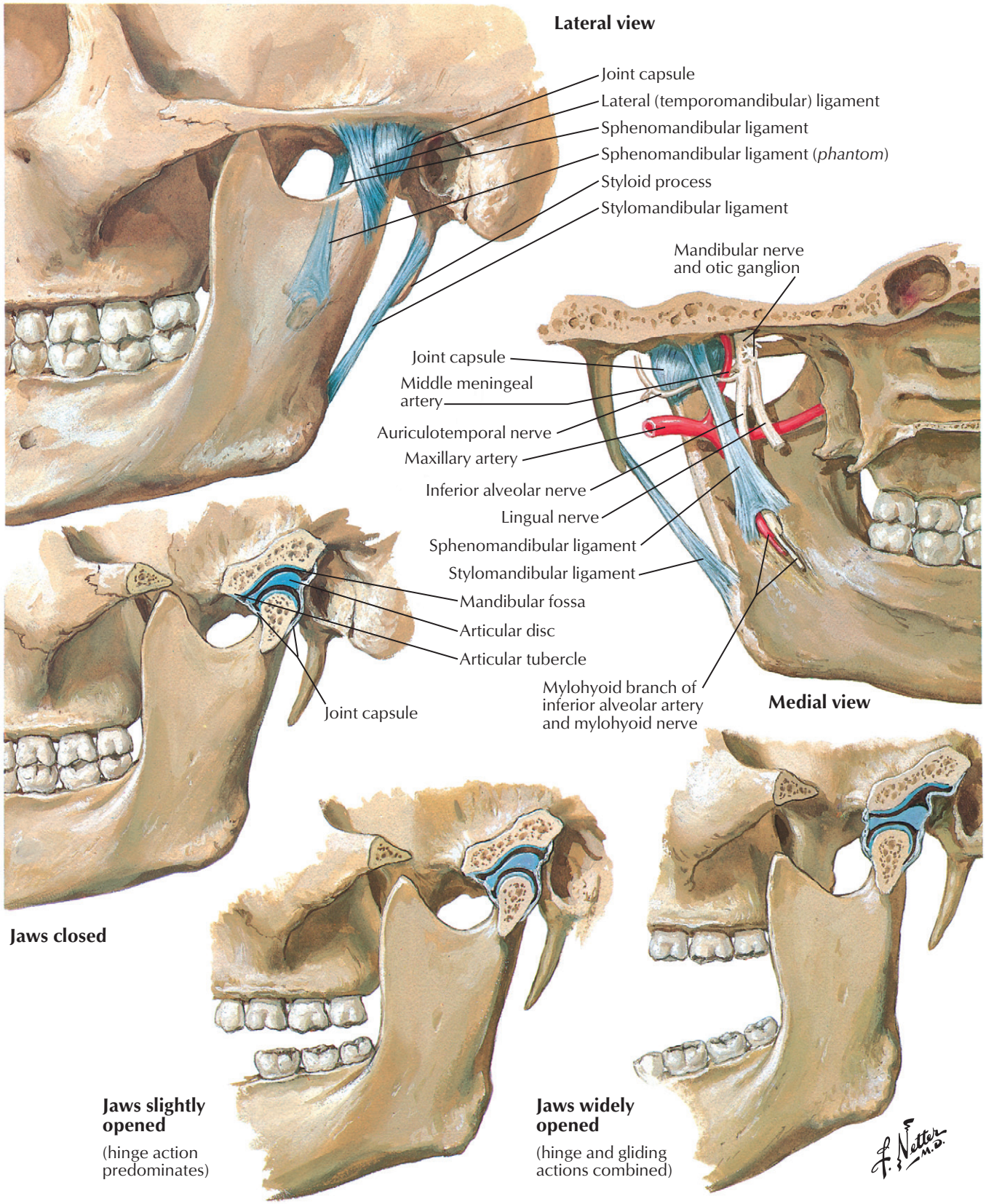
Inferolateral view

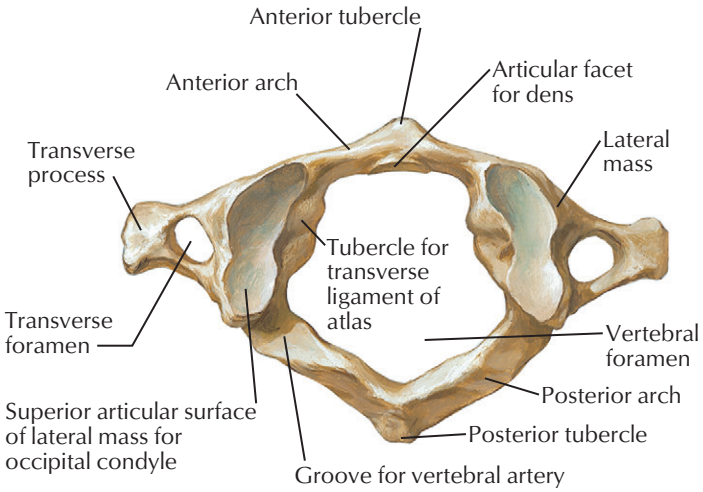




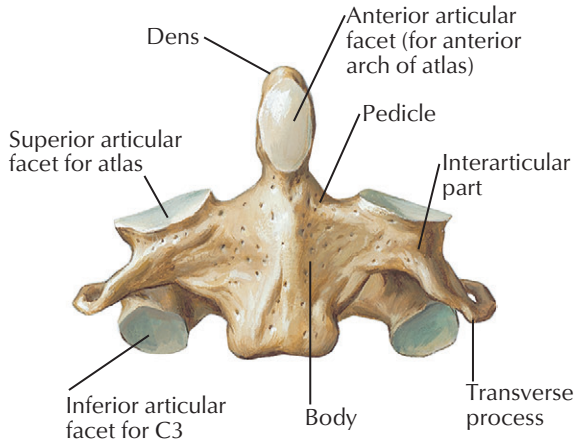


Mandible of aged person (edentulous)

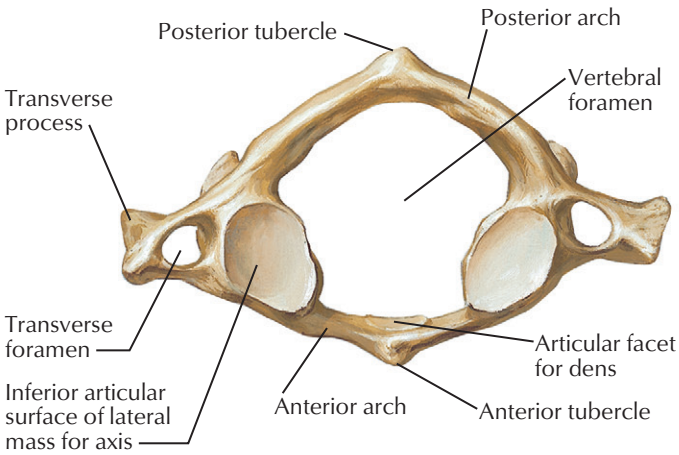

Lateral view
Joint capsule
Lateral (temporomandibular) ligament
Sphenomandibular ligament
Sphenomandibular ligament (phantom)
Styloid process
Stylomandibular ligament
Mandibular nerve and otic ganglion
Joint capsule
Middle meningeal artery
Auriculotemporal nerve
Maxillary artery
Inferior alveolar nerve
Lingual nerve
Sphenomandibular ligament
Stylomandibular ligament
Mylohyoid branch of inferior alveolar artery and mylohyoid nerve
Medial view
Mandibular fossa
Articular disc
Articular tubercle
Joint capsule
Jaws closed
Jaws slightly opened
(hinge action predominates)
Jaws widely opened
(hinge and gliding actions combined)



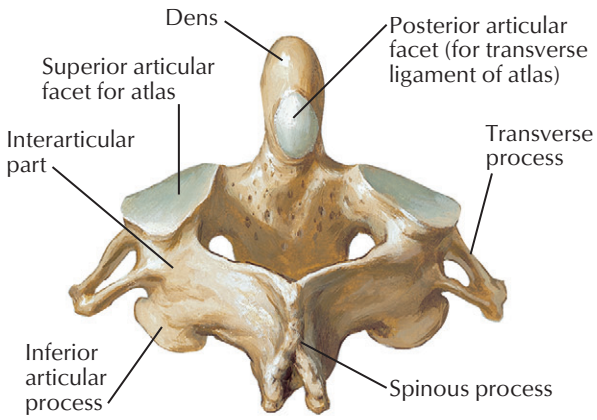
Atlas (C1): superior view



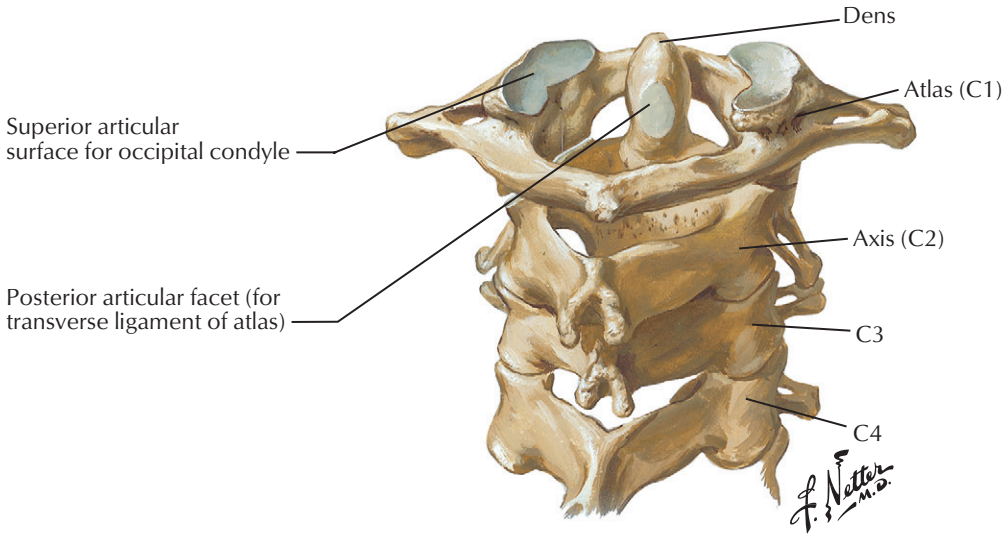
Axis (C2): anterior view



Atlas (C1): inferior view



Axis (C2): posterosuperior view

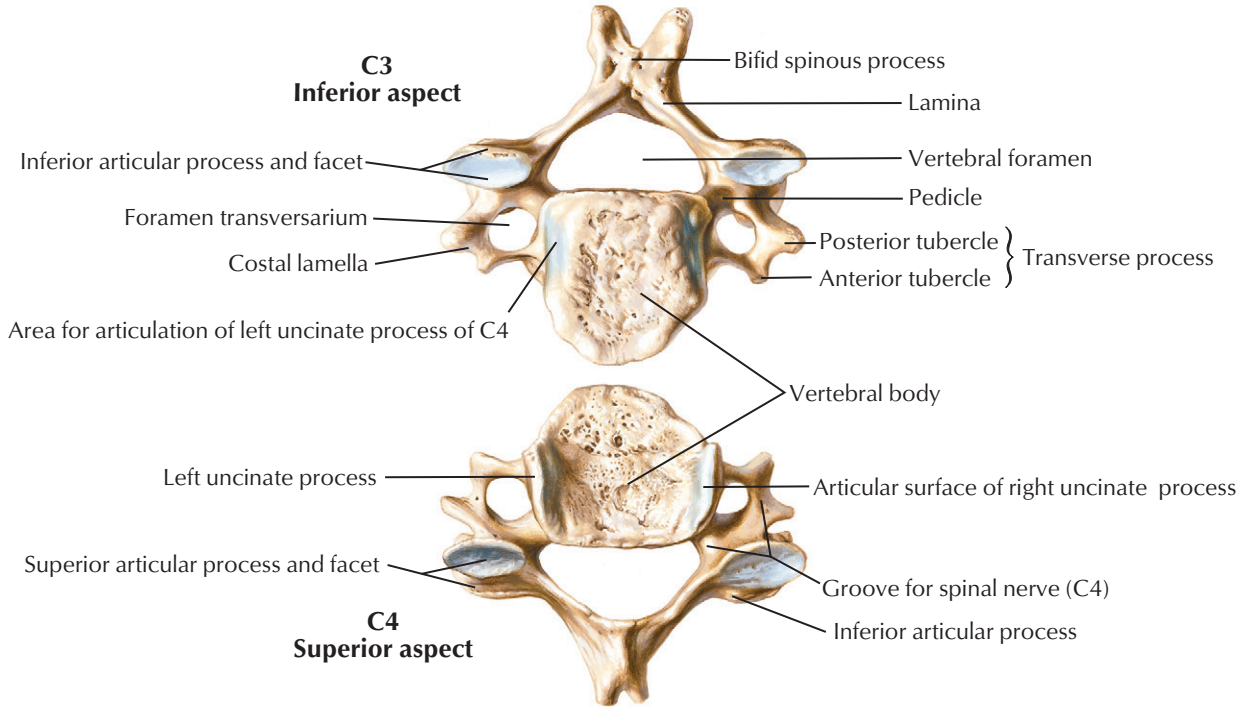


Upper cervical vertebrae, assembled: posterosuperior view

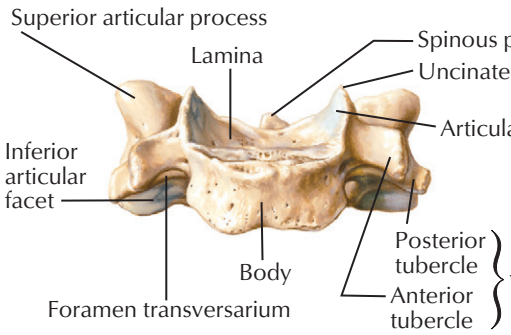
Cervical Vertebrae (continued)

See also Plates 21, 22

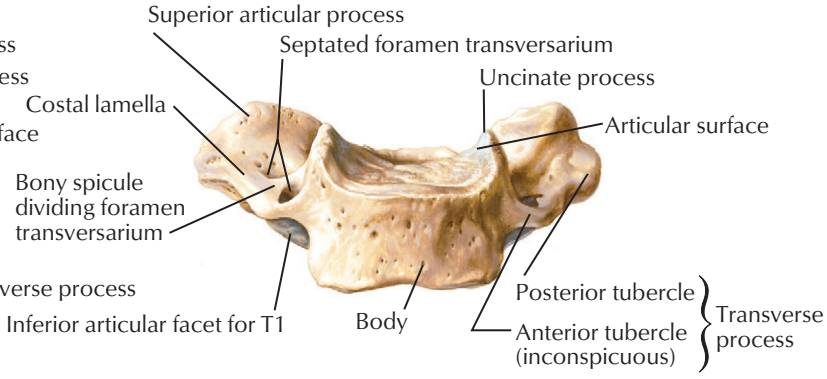
Inferior aspect of C3 and superior aspect of C4 showing the sites of the facet and uncovertebral articulations



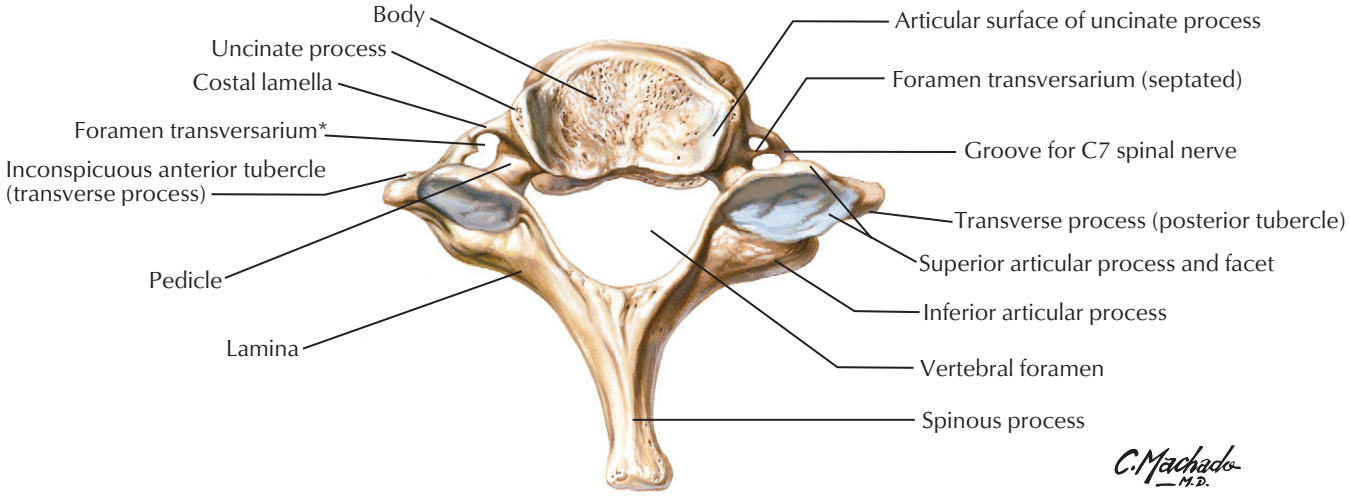
4th cervical vertebra: anterior view



7th cervical vertebra: anterior view

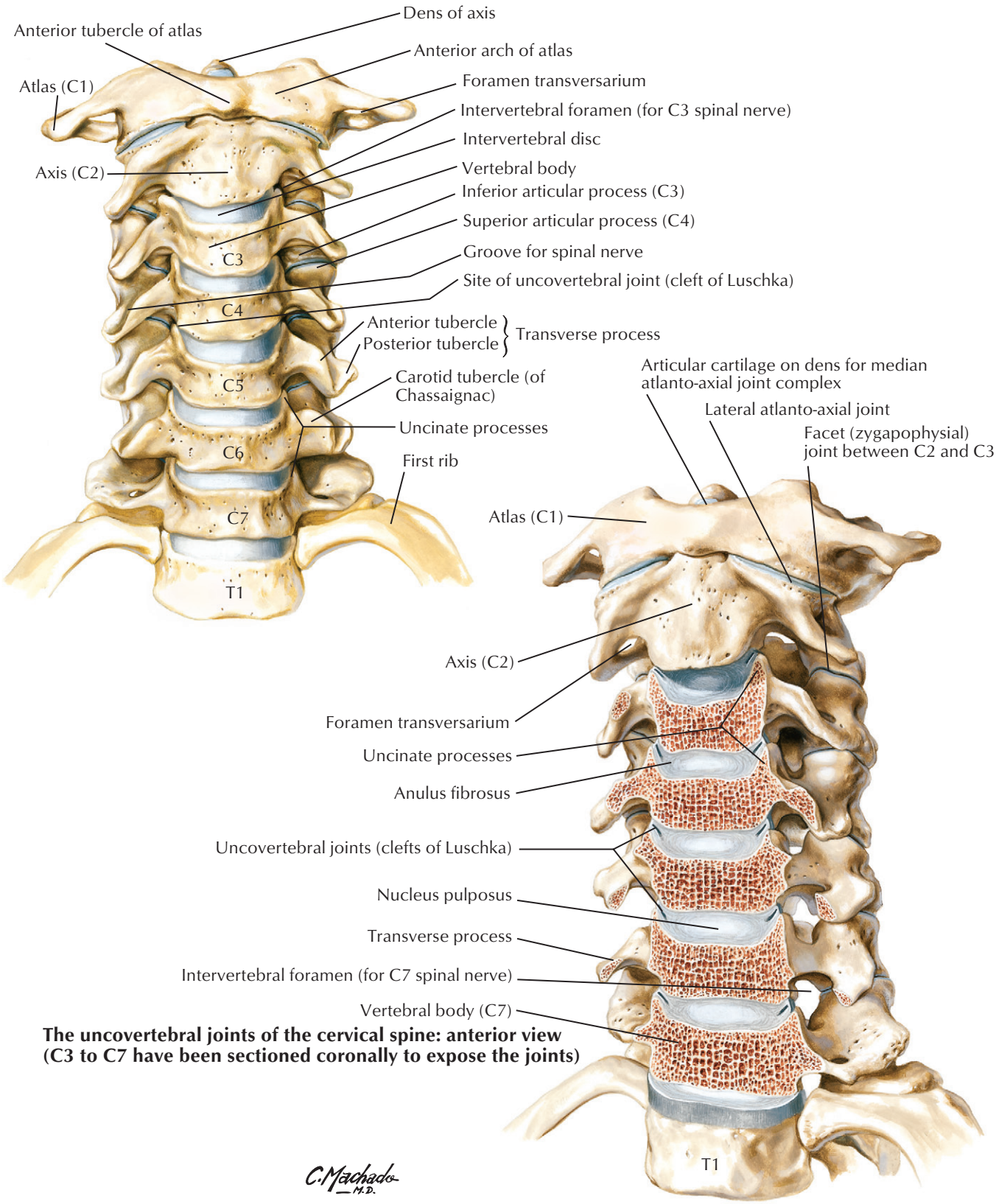


7th cervical vertebra (vertebra prominens): superior view

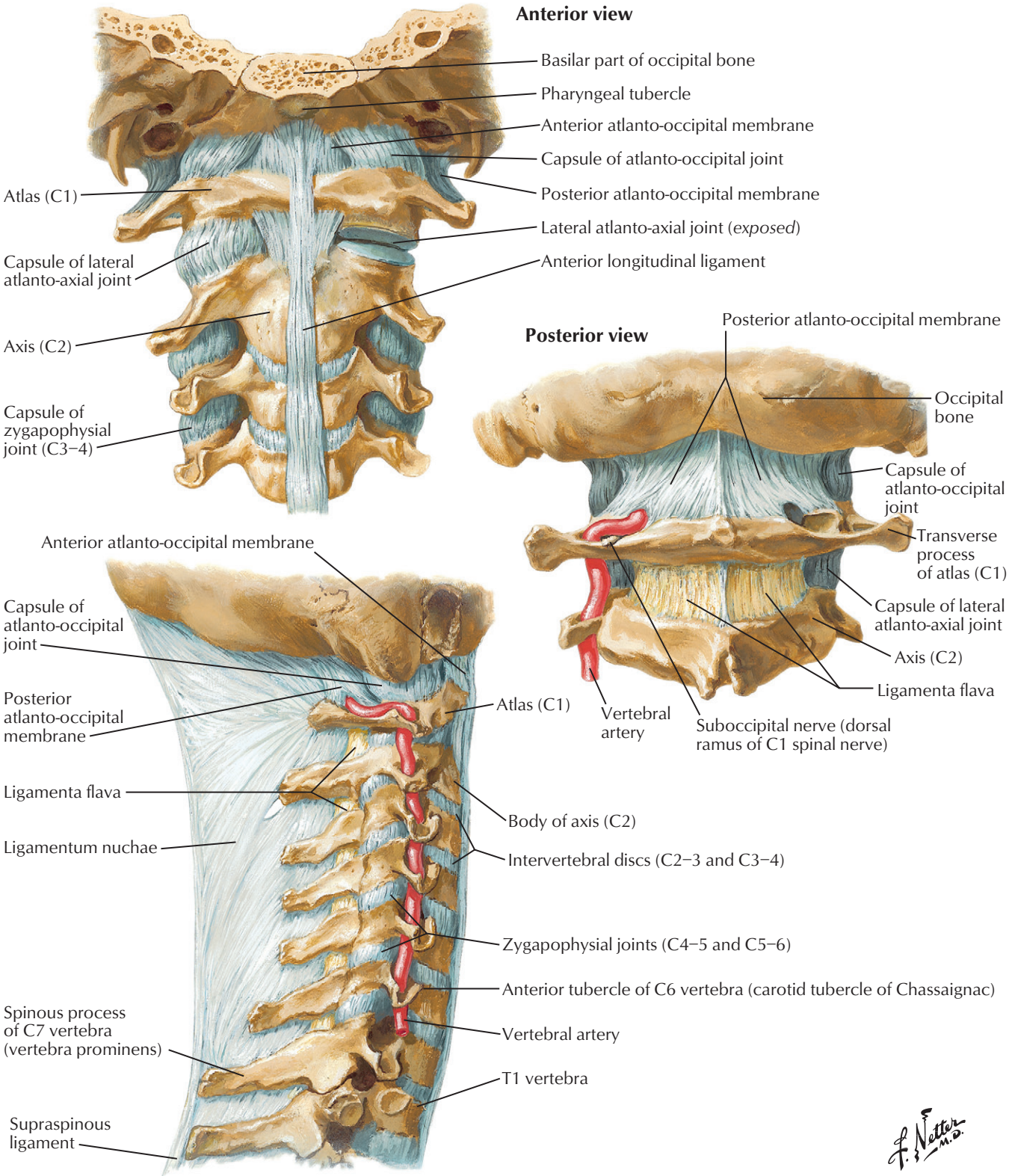


**The foramina transversaria of C7 transmit vertebral veins, but usually not the vertebral artery, and are asymmetrical in this specimen.*

Cervical vertebrae: anterior view

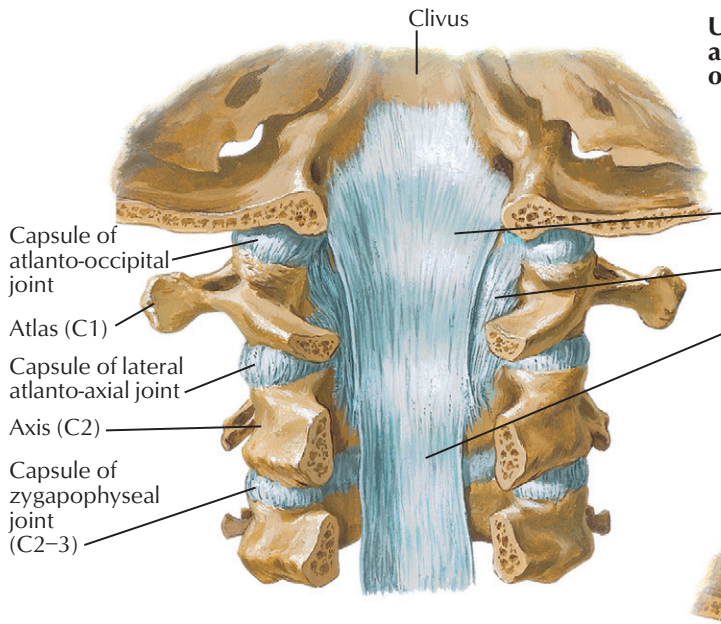


The uncovertebral joints of the cervical spine: anterior view (C3 to C7 have been sectioned coronally to expose the joints)

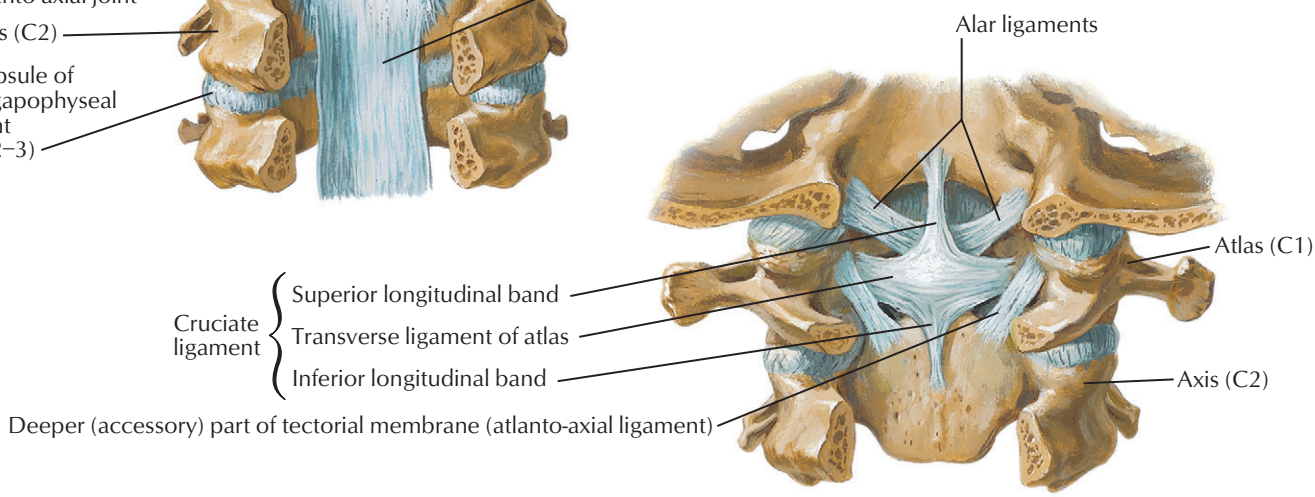

Anterior view
Basilar part of occipital bone
Pharyngeal tubercle
Anterior atlanto-occipital membrane
Capsule of atlanto-occipital joint
Posterior atlanto-occipital membrane
Lateral atlanto-axial joint (exposed)
Anterior longitudinal ligament
Atlas (C1)
Capsule of lateral atlanto-axial joint
Axis (C2)
Capsule of zygapophysial joint (C3–4)
Posterior view
Posterior atlanto-occipital membrane
Occipital bone
Capsule of atlanto-occipital joint
Transverse process of atlas (C1)
Capsule of lateral atlanto-axial joint
Axis (C2)
Ligamenta flava
Vertebral artery
Suboccipital nerve (dorsal ramus of C1 spinal nerve)
Anterior atlanto-occipital membrane
Capsule of atlanto-occipital joint
Posterior atlanto-occipital membrane
Atlas (C1)
Ligamenta flava
Ligamentum nuchae
Body of axis (C2)
Intervertebral discs (C2–3 and C3–4)
Zygapophysial joints (C4–5 and C5–6)
Anterior tubercle of C6 vertebra (carotid tubercle of Chassaignac)
Vertebral artery
T1 vertebra
Spinous process of C7 vertebra (vertebra prominens)
Supraspinous ligament
Right lateral view

Internal Craniocervical Ligaments

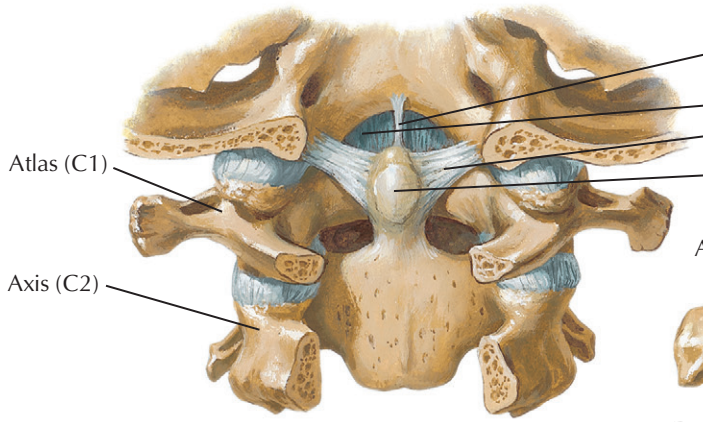
See also Plates 46, 124



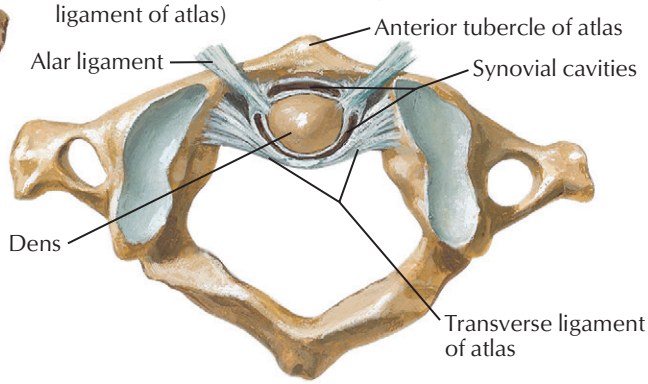
Upper part of vertebral canal with spinous processes and parts of vertebral arches removed to expose ligaments on posterior vertebral bodies: posterior view



Principal part of tectorial membrane removed to expose deeper ligaments: posterior view



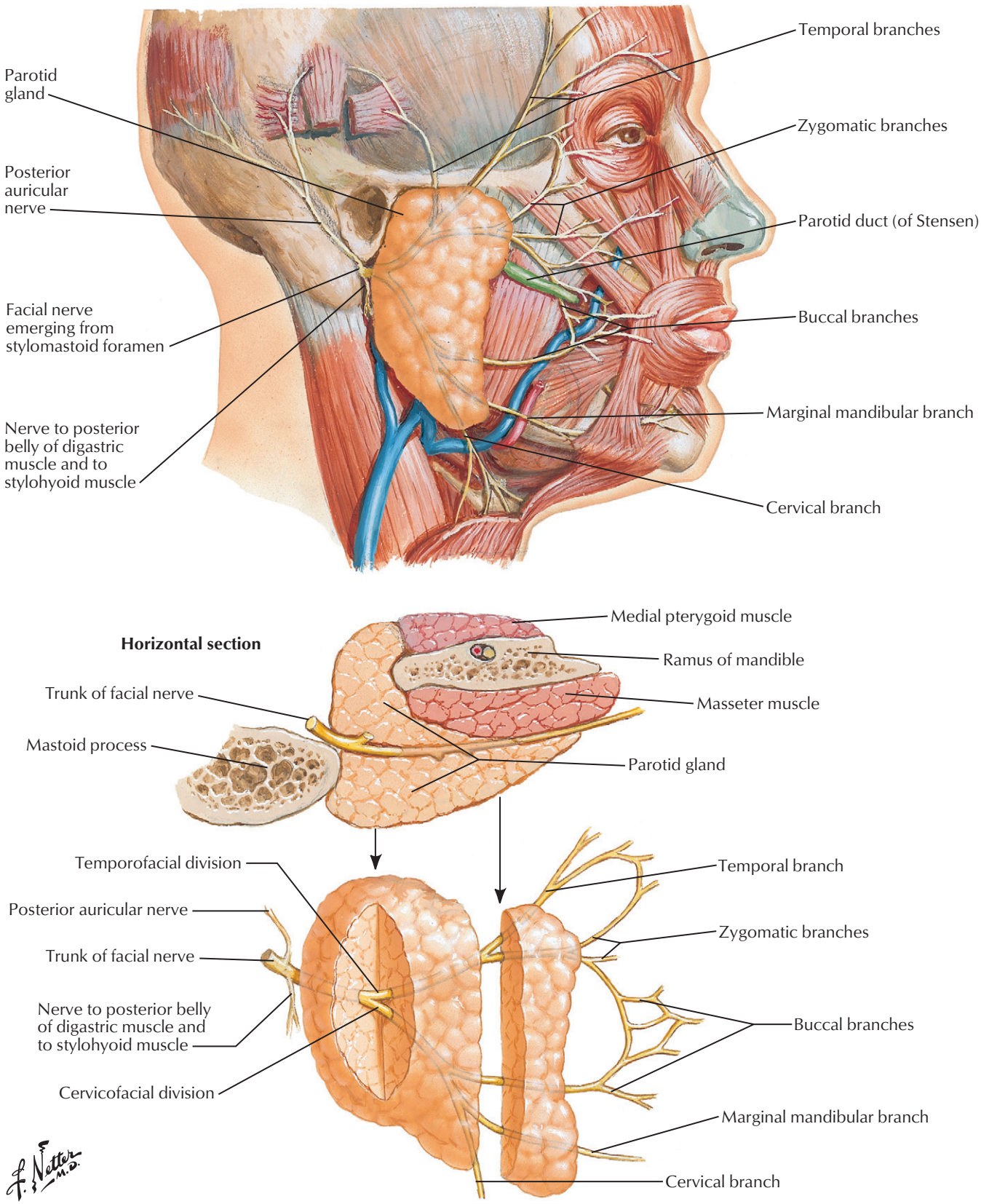
Cruciate ligament removed to show deeper ligaments: posterior view



Median atlanto-axial joint: superior view

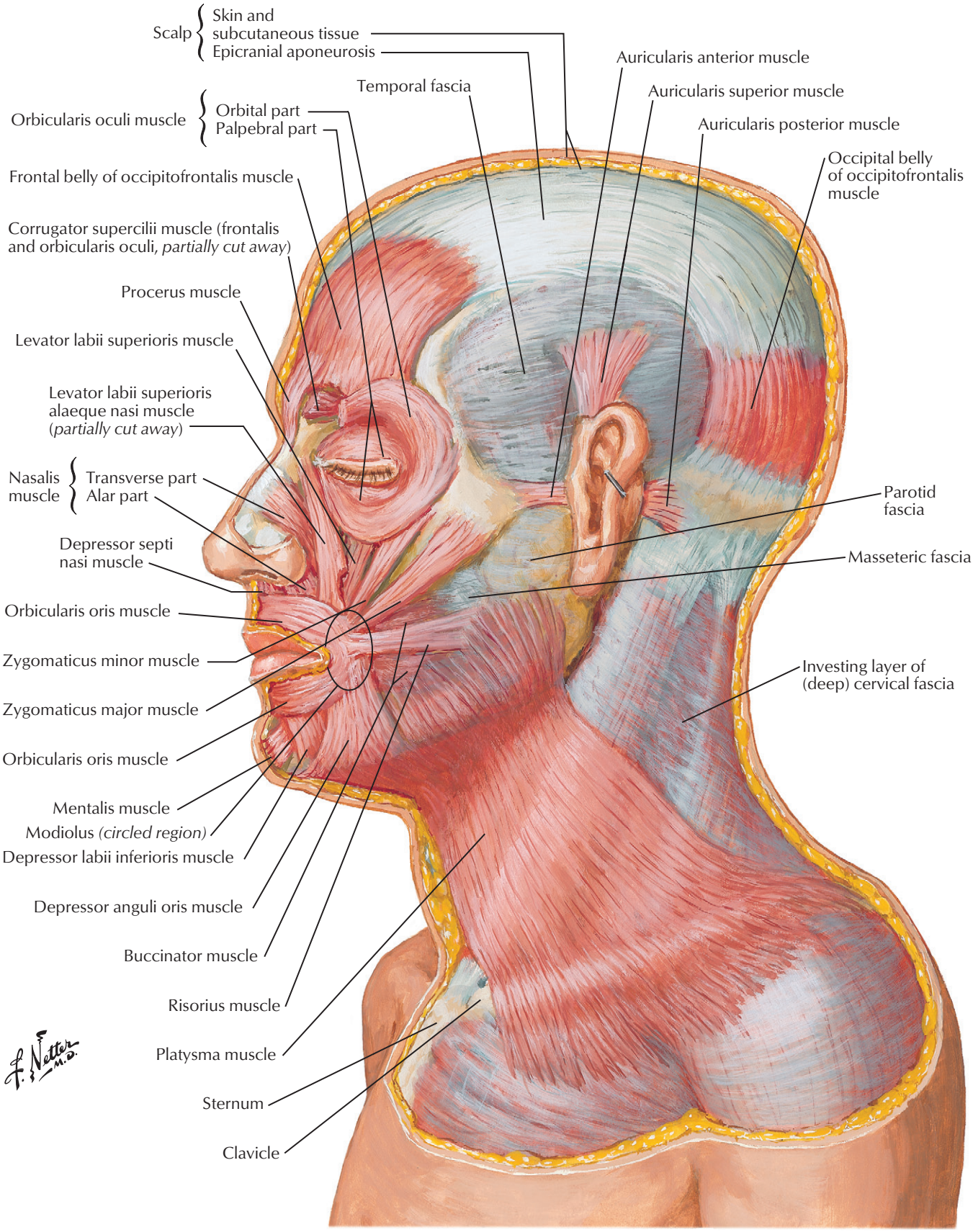
Facial Nerve Branches and Parotid Gland

See also Plates 46, 124



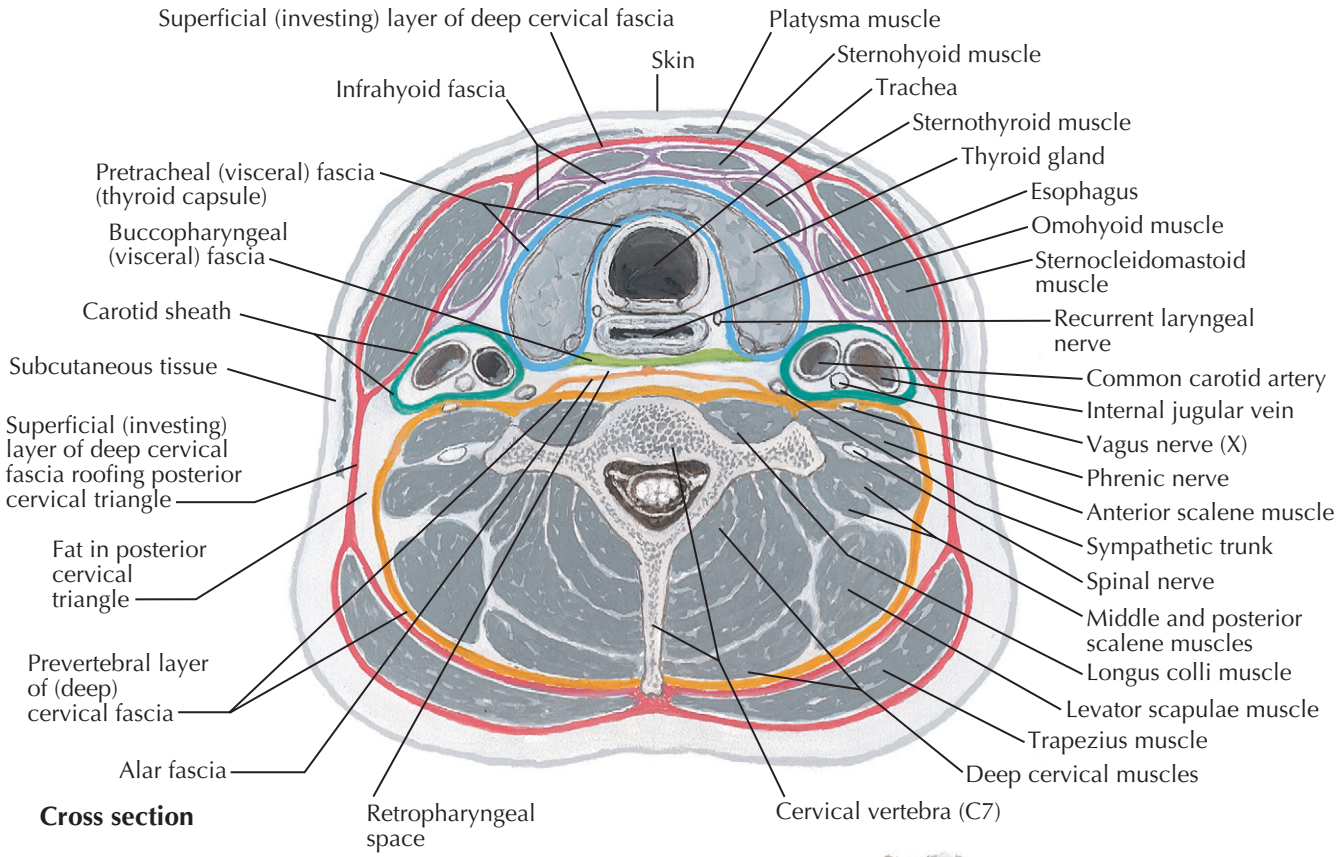
Muscles of Facial Expression: Lateral View

See also Plates 48, 49

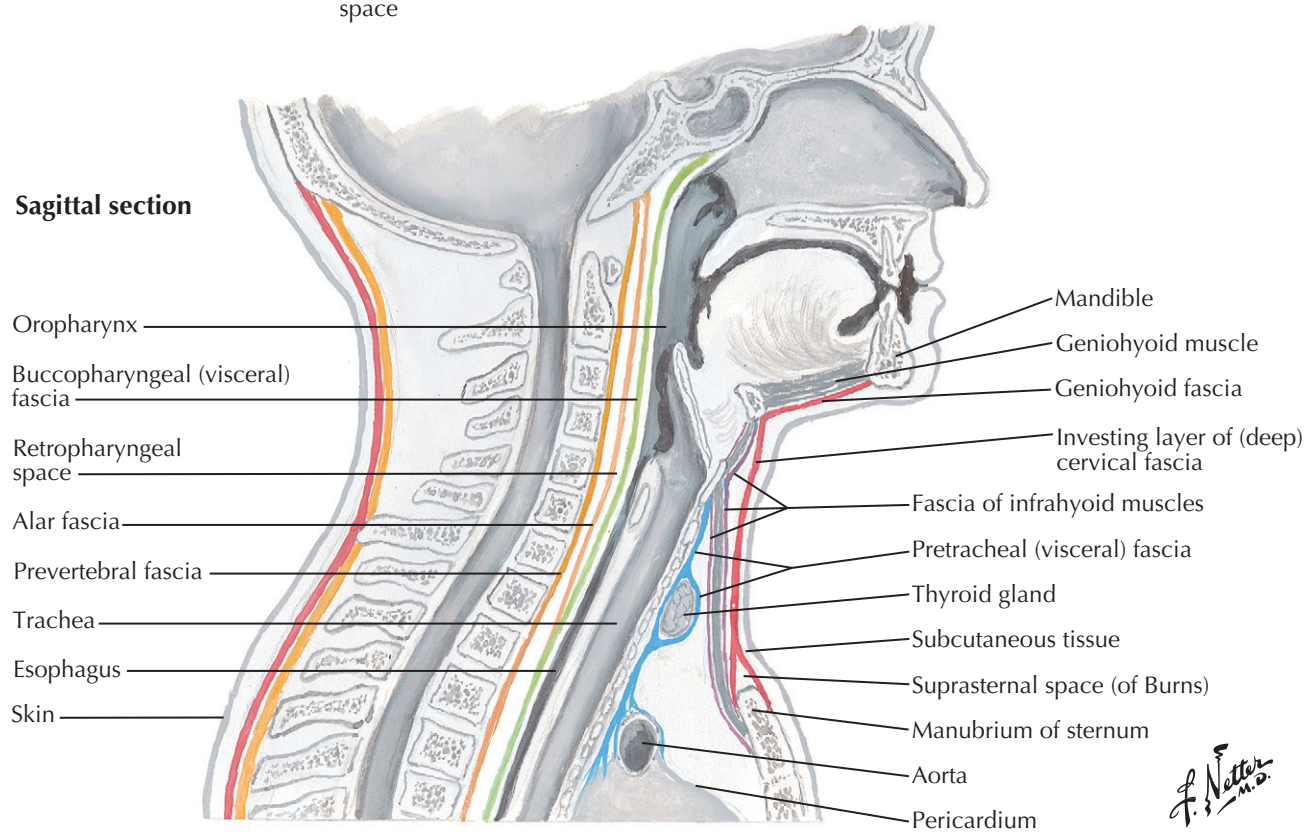


Fascial Layers of Neck

See also Plate 27



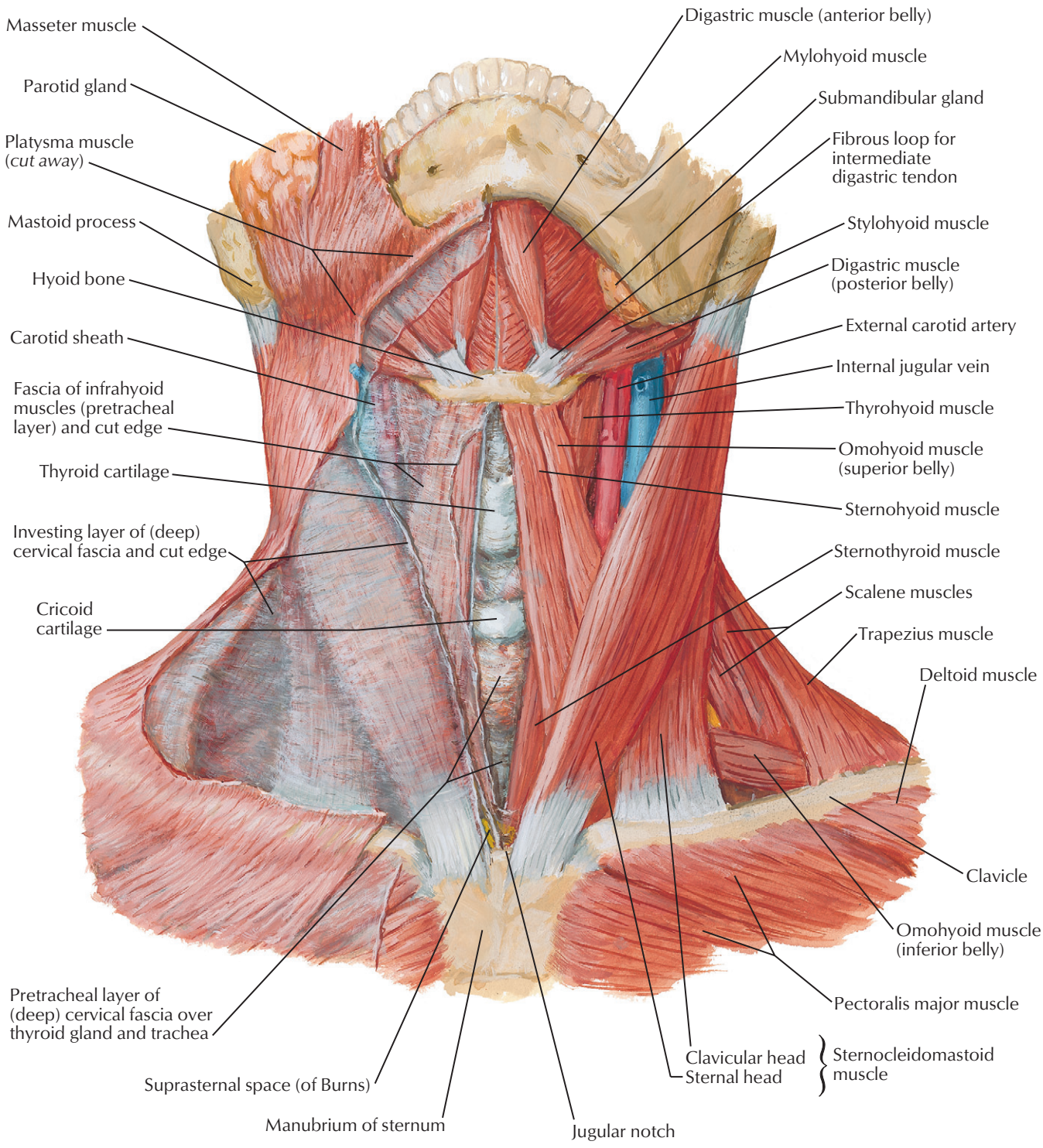
Cross section



Sagittal section

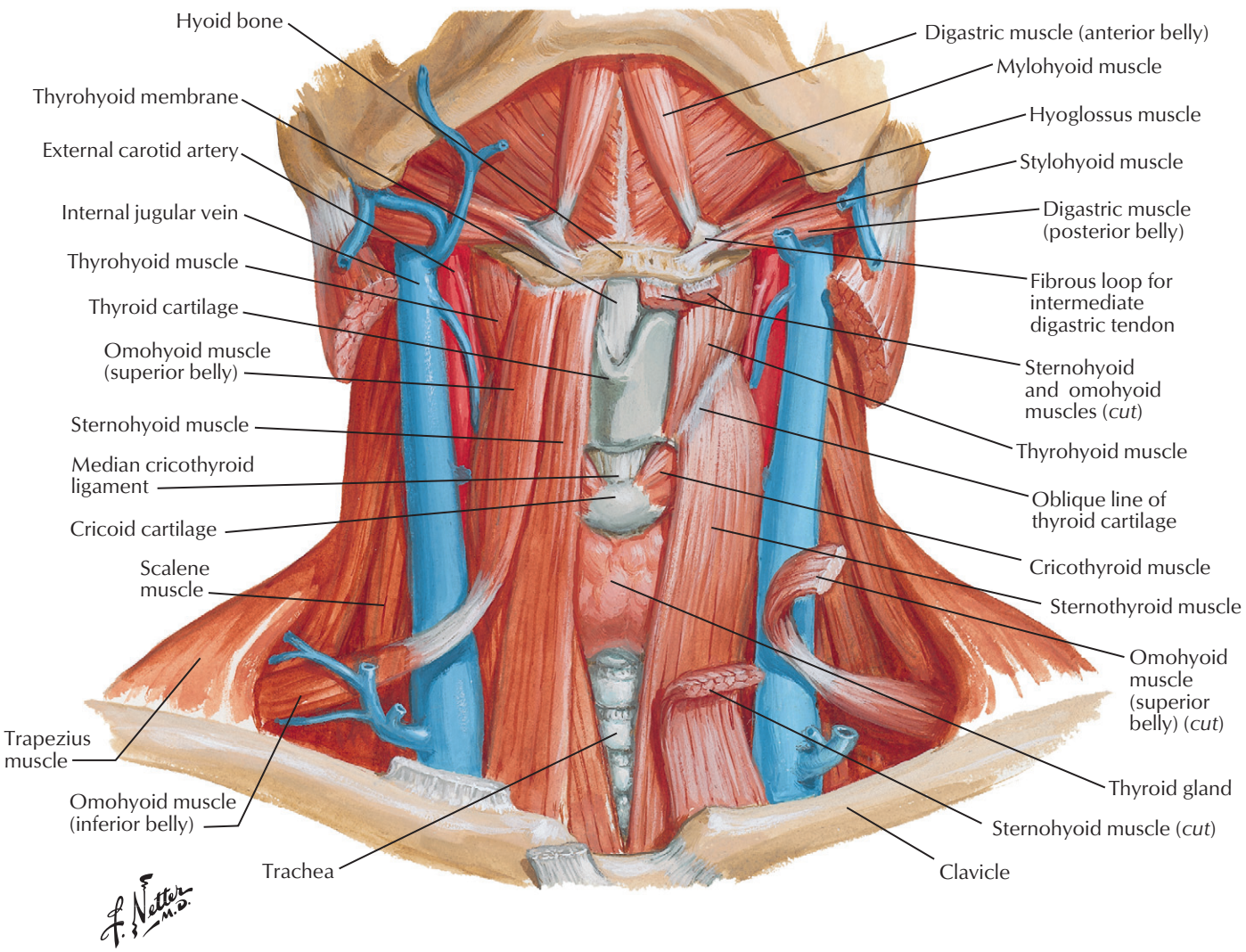
Muscles of Neck: Anterior View

See also Plates 26, 28, 31



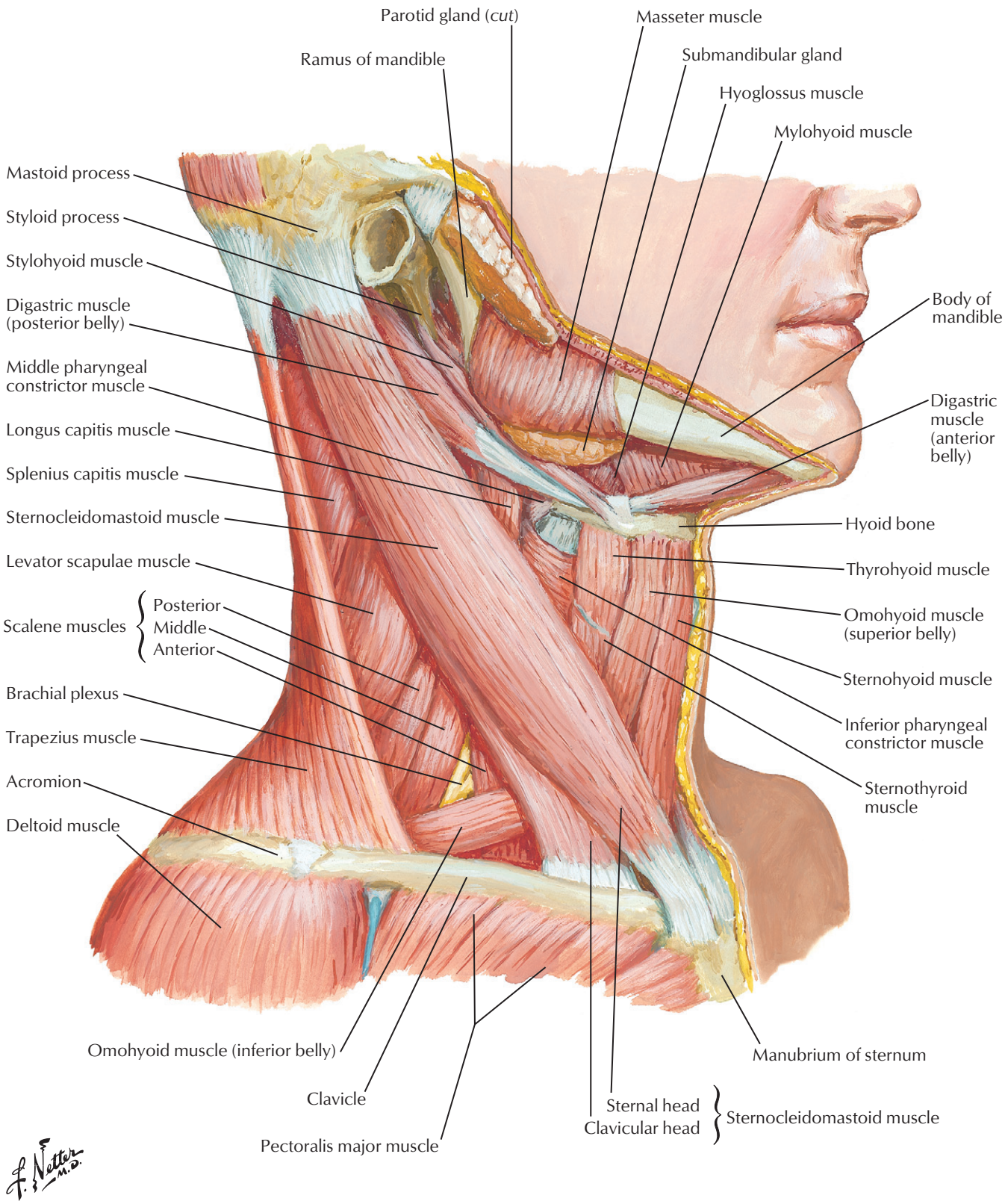
Infrahyoid and Suprahyoid Muscles

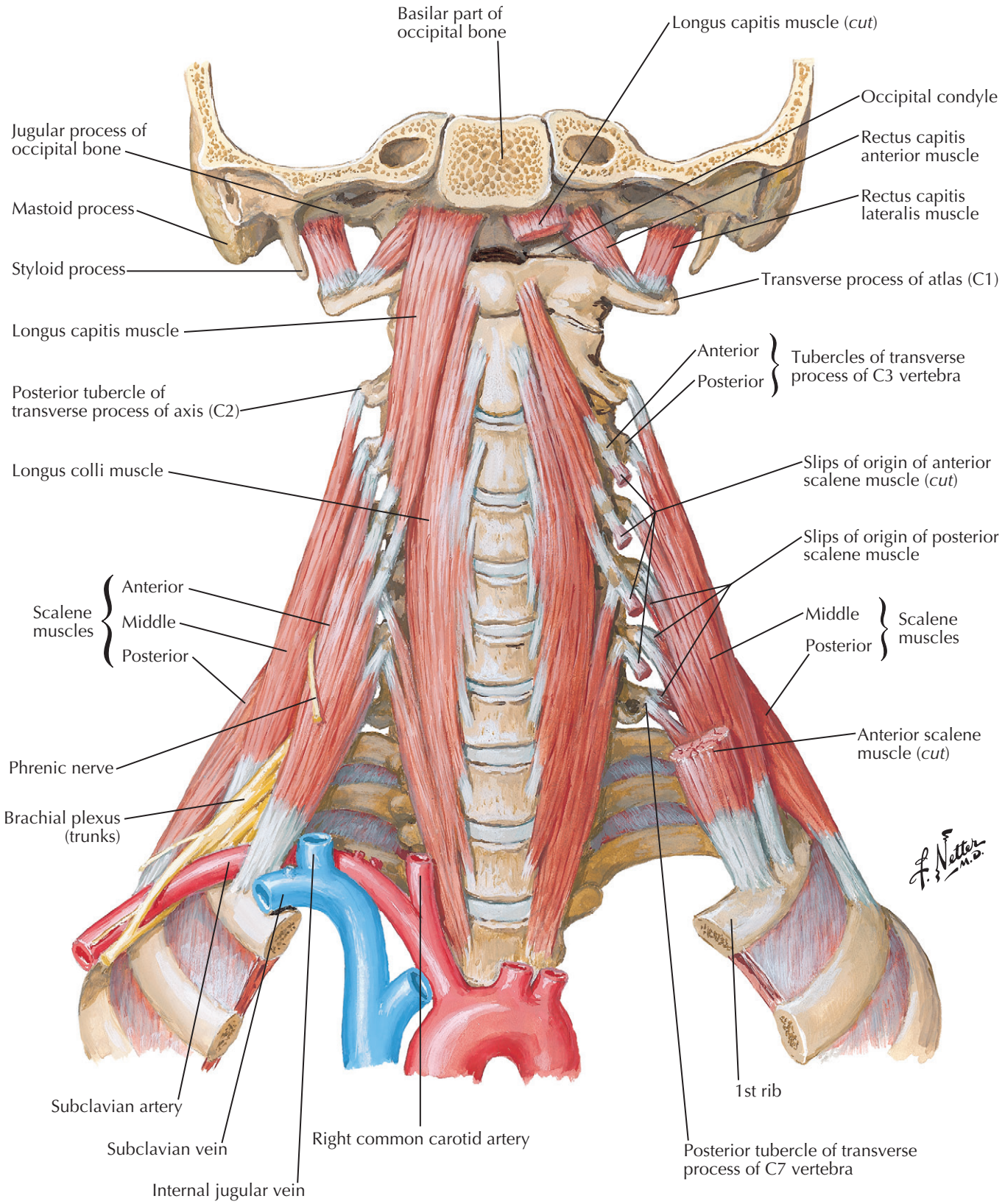
See also Plates 27, 29, 58



Muscles of Neck: Lateral View

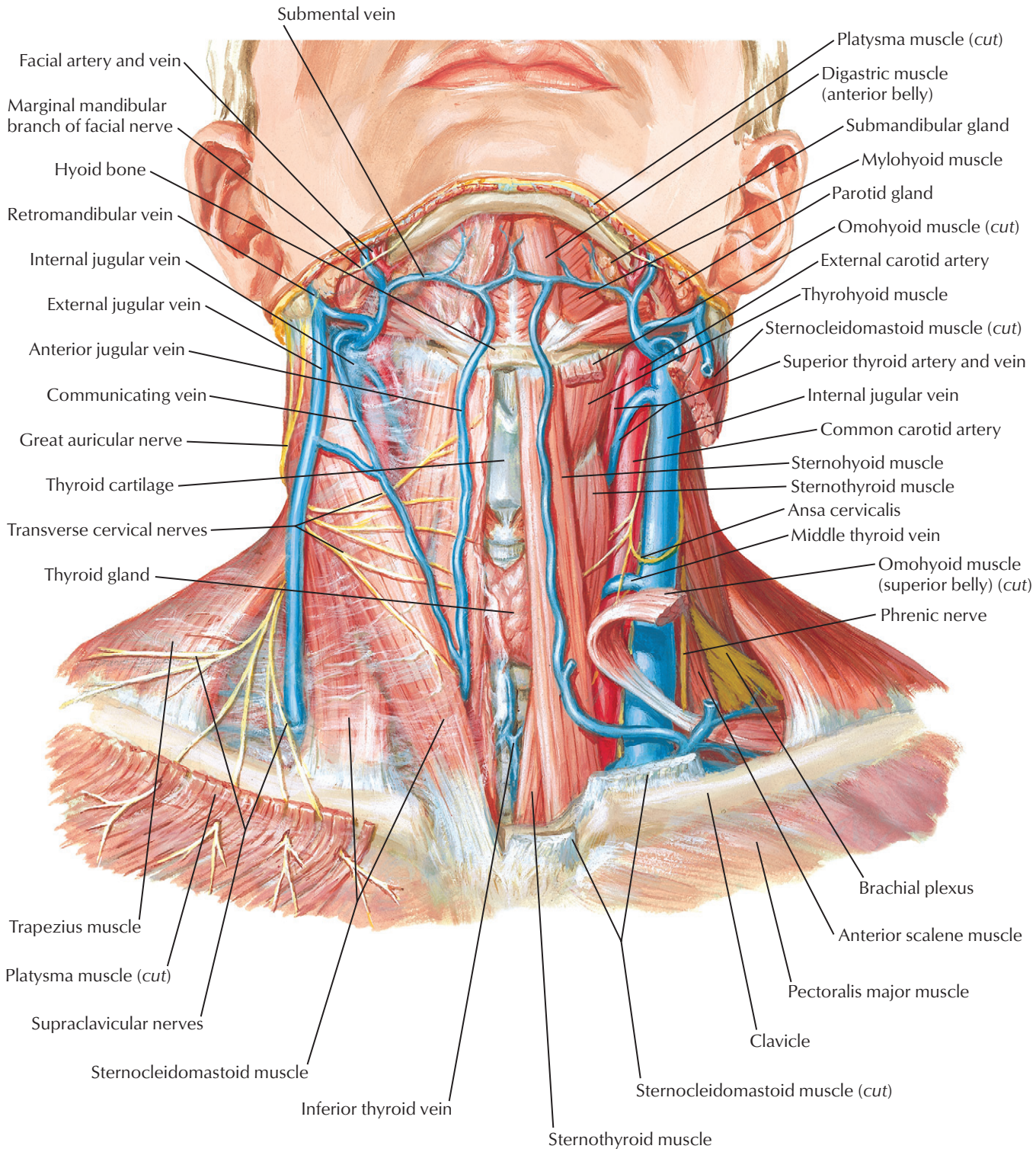
See also Plates 27, 28, 31



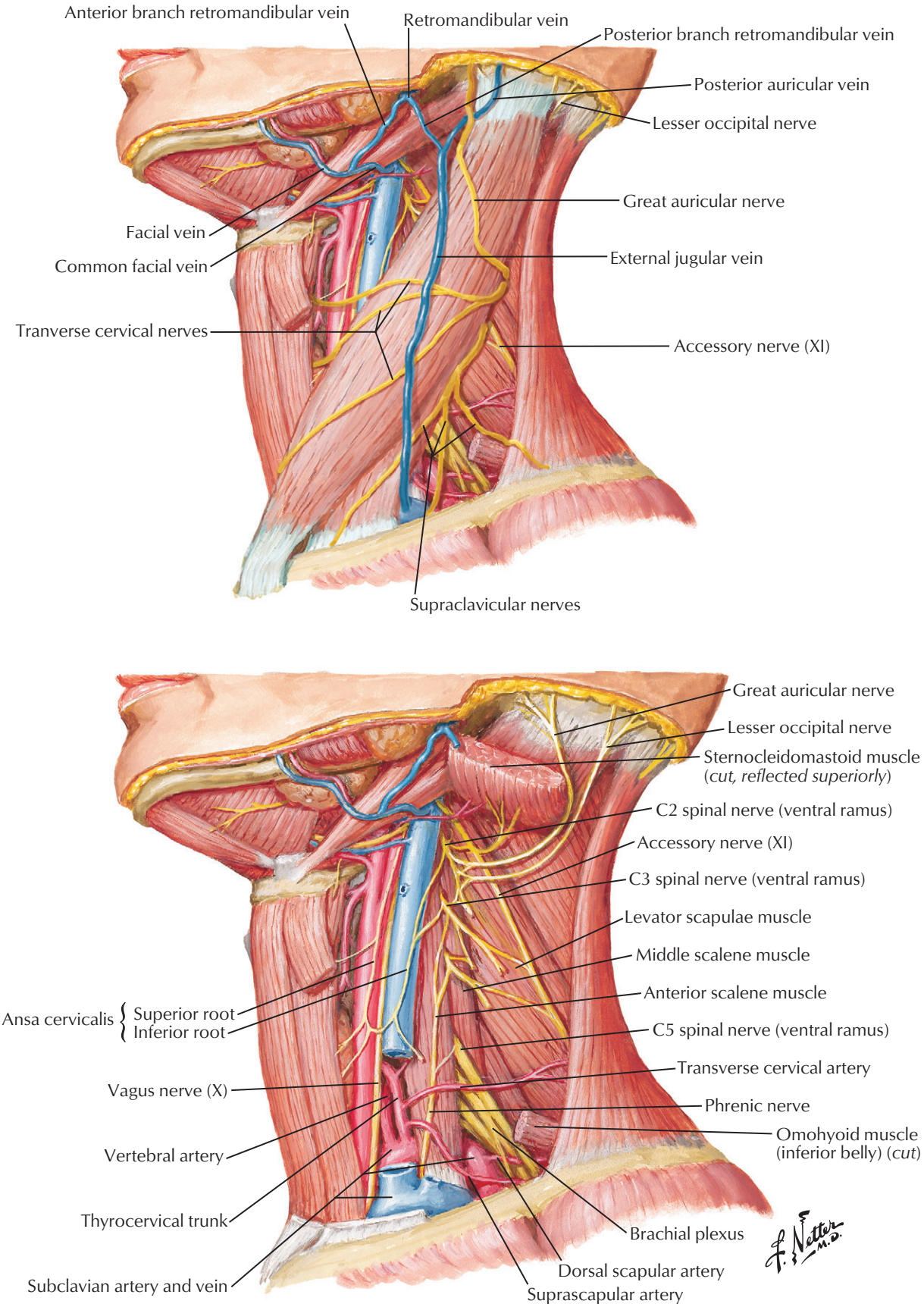

Basilar part of occipital bone
Longus capitis muscle (*cut*)
Occipital condyle
Jugular process of occipital bone
Rectus capitis anterior muscle
Mastoid process
Rectus capitis lateralis muscle
Styloid process
Transverse process of atlas (C1)
Longus capitis muscle
Anterior
Posterior
Tubercles of transverse process of C3 vertebra
Posterior tubercle of transverse process of axis (C2)
Longus colli muscle
Slips of origin of anterior scalene muscle (*cut*)
Slips of origin of posterior scalene muscle
Scalene muscles
Anterior
Middle
Posterior
Middle
Posterior
Scalene muscles
Anterior scalene muscle (*cut*)
Phrenic nerve
Brachial plexus (trunks)
1st rib
Subclavian artery
Subclavian vein
Right common carotid artery
Posterior tubercle of transverse process of C7 vertebra
Internal jugular vein

Superficial Veins and Cutaneous Nerves of Neck

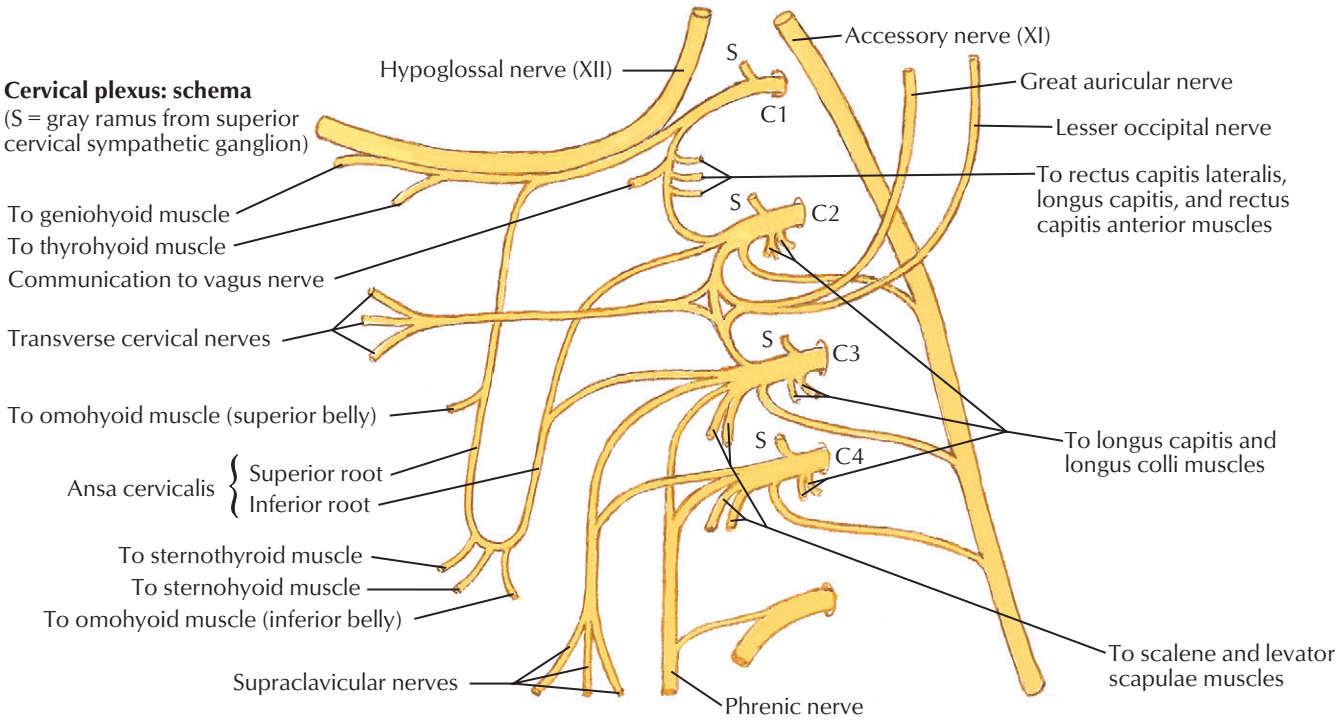
For deep veins of neck see Plate 73



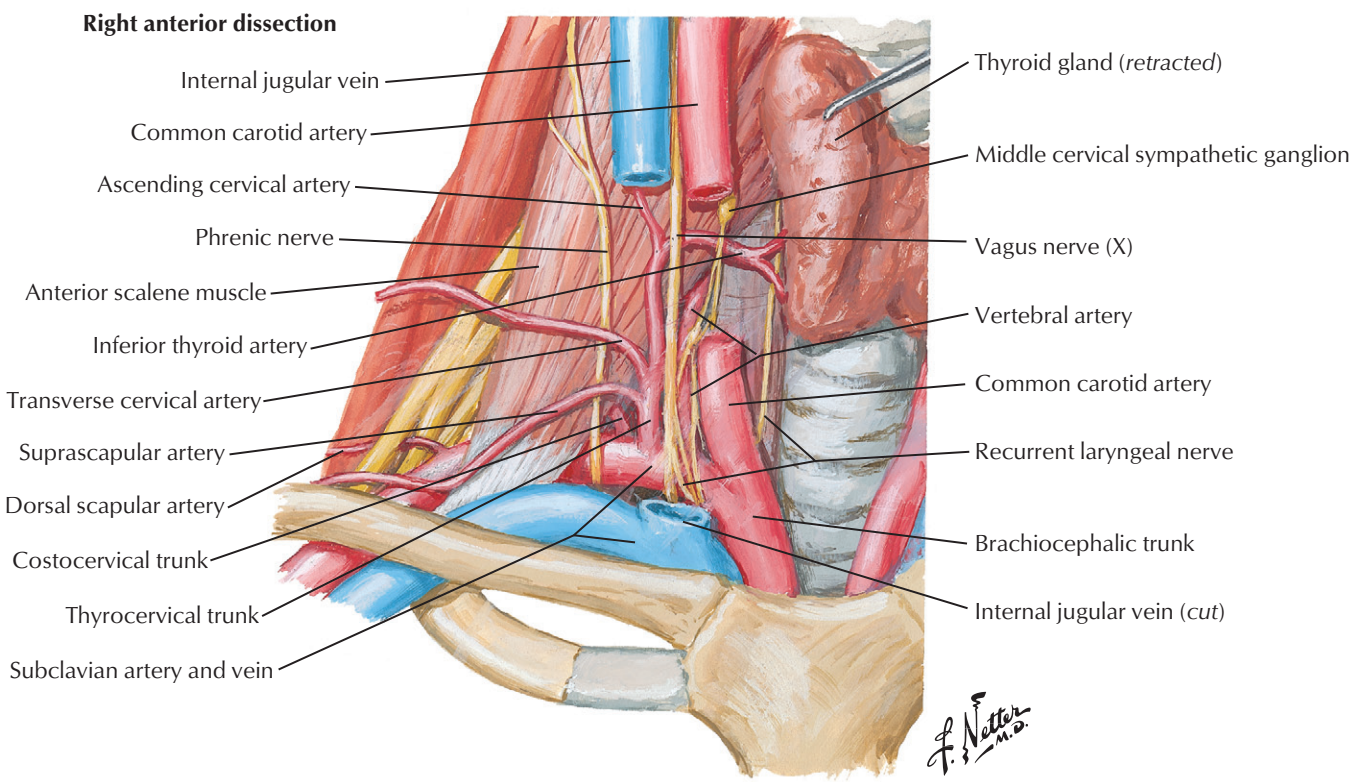
See also Plates 128–130



Cervical plexus: schema
(S = gray ramus from superior cervical sympathetic ganglion)



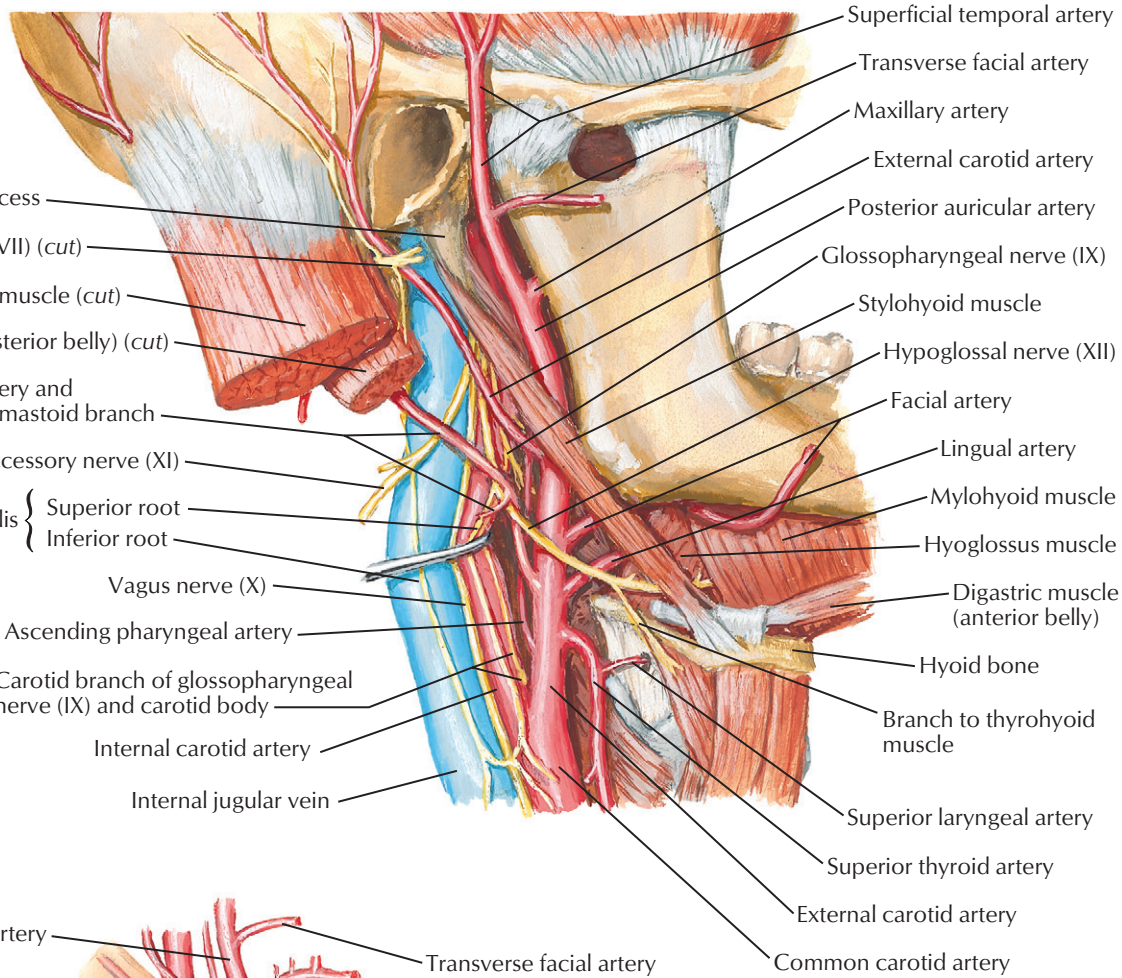
Right anterior dissection

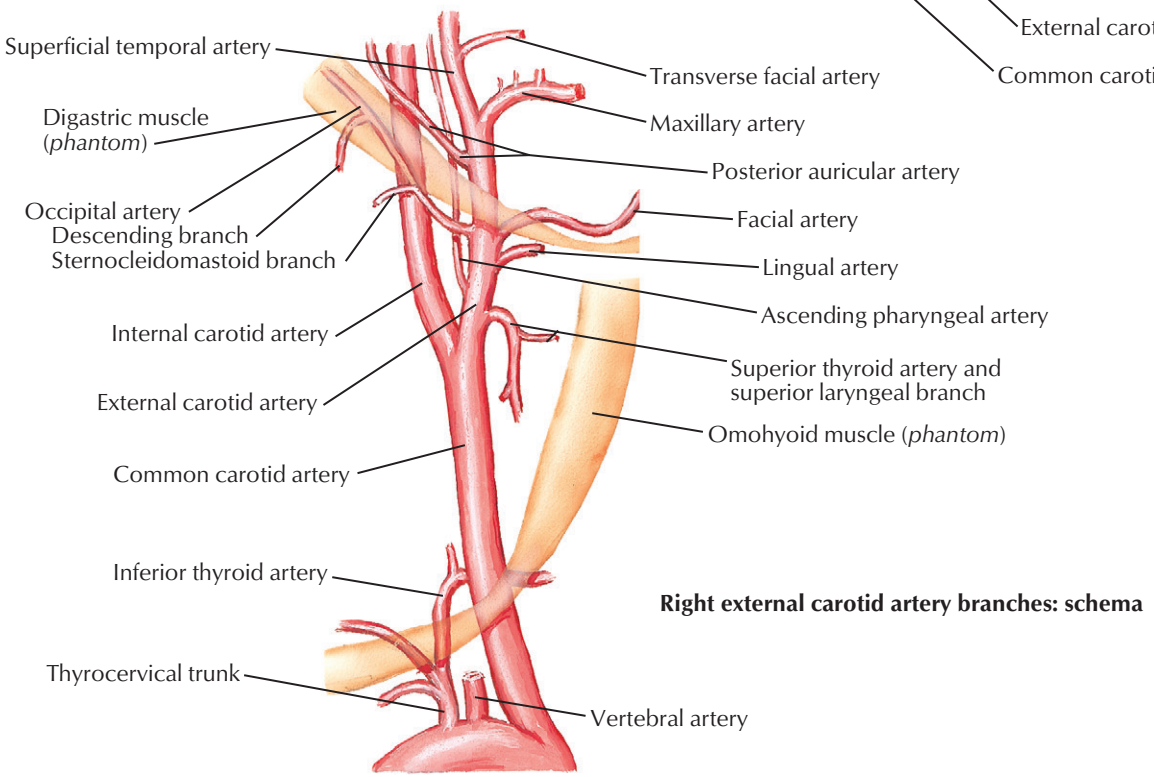


Carotid Arteries

See also Plates 3, 137, 139

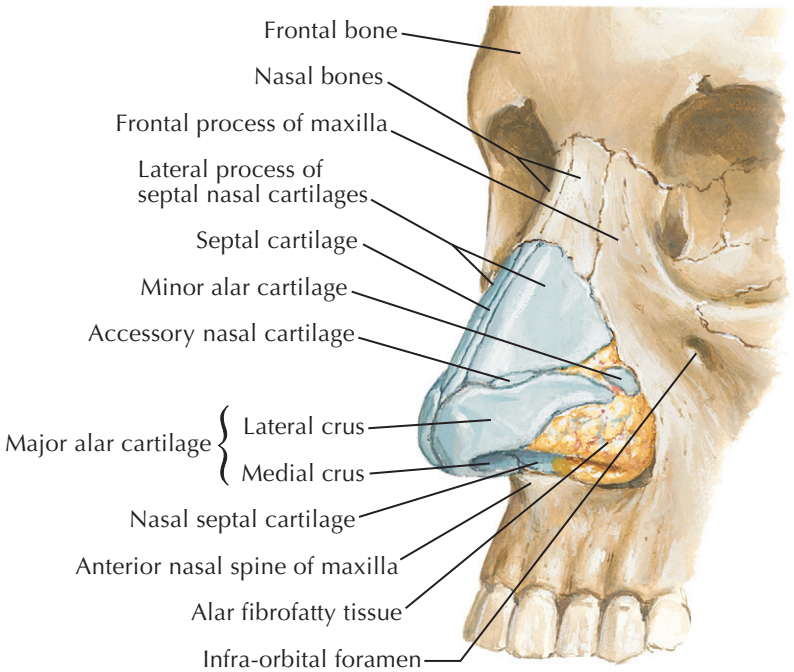
Parotid space (bed): right lateral dissection



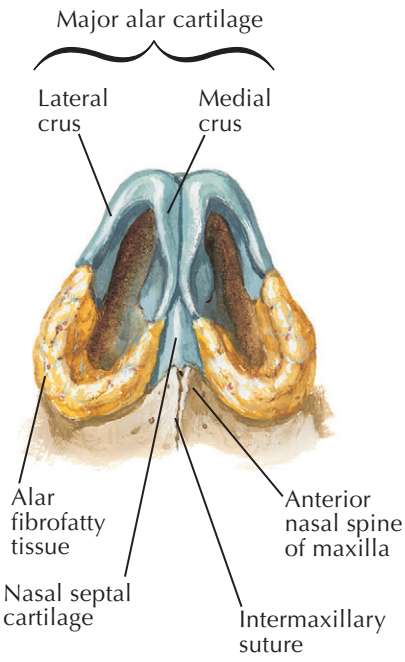


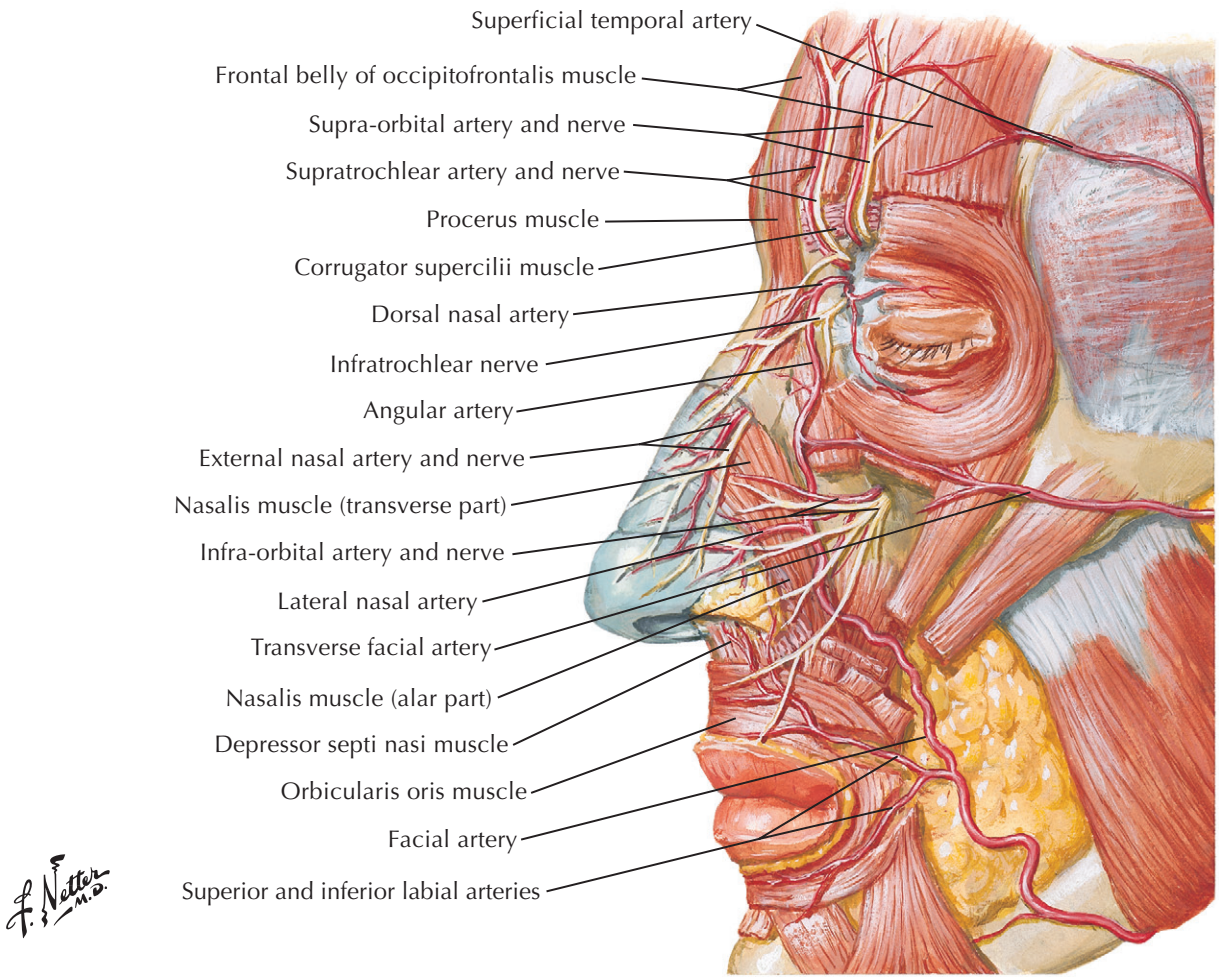
Right external carotid artery branches: schema

Anterolateral view

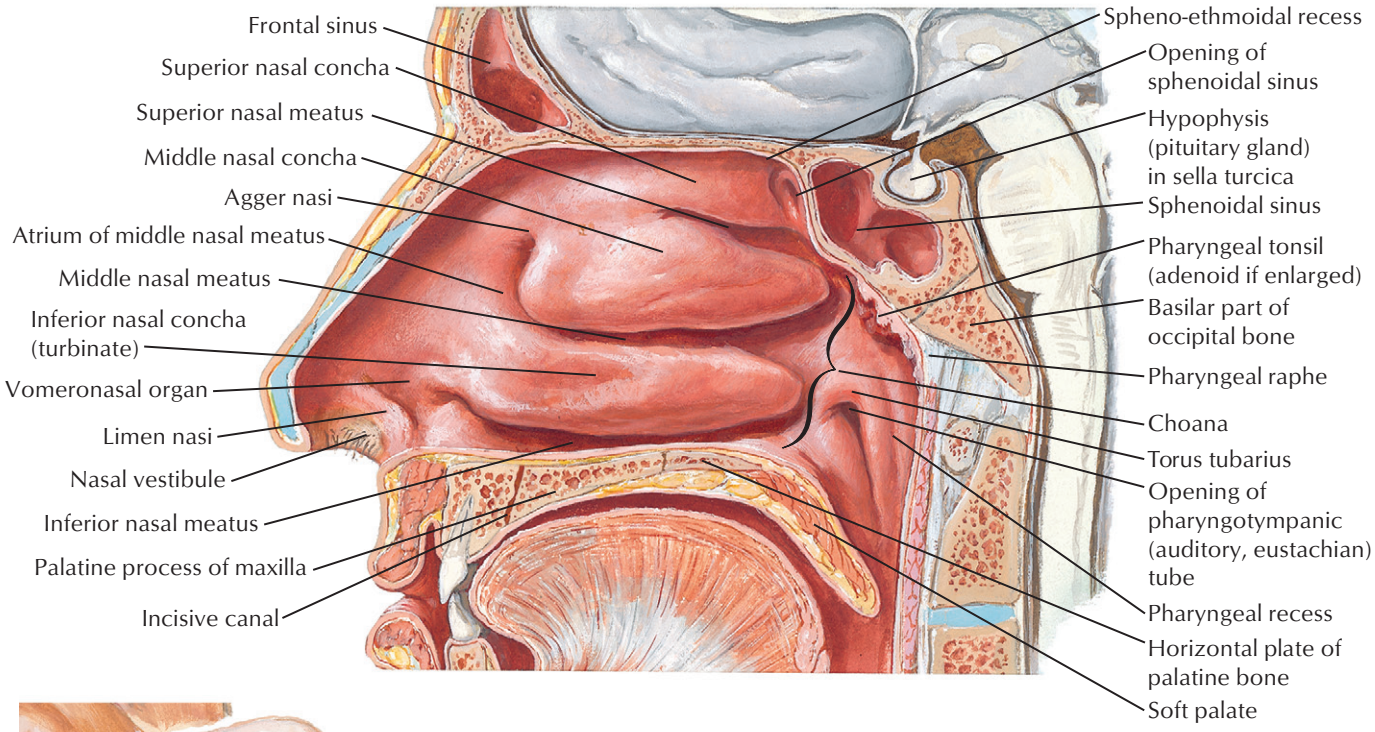


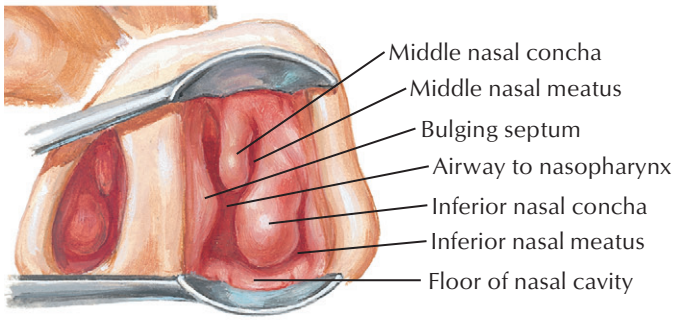
Inferior view



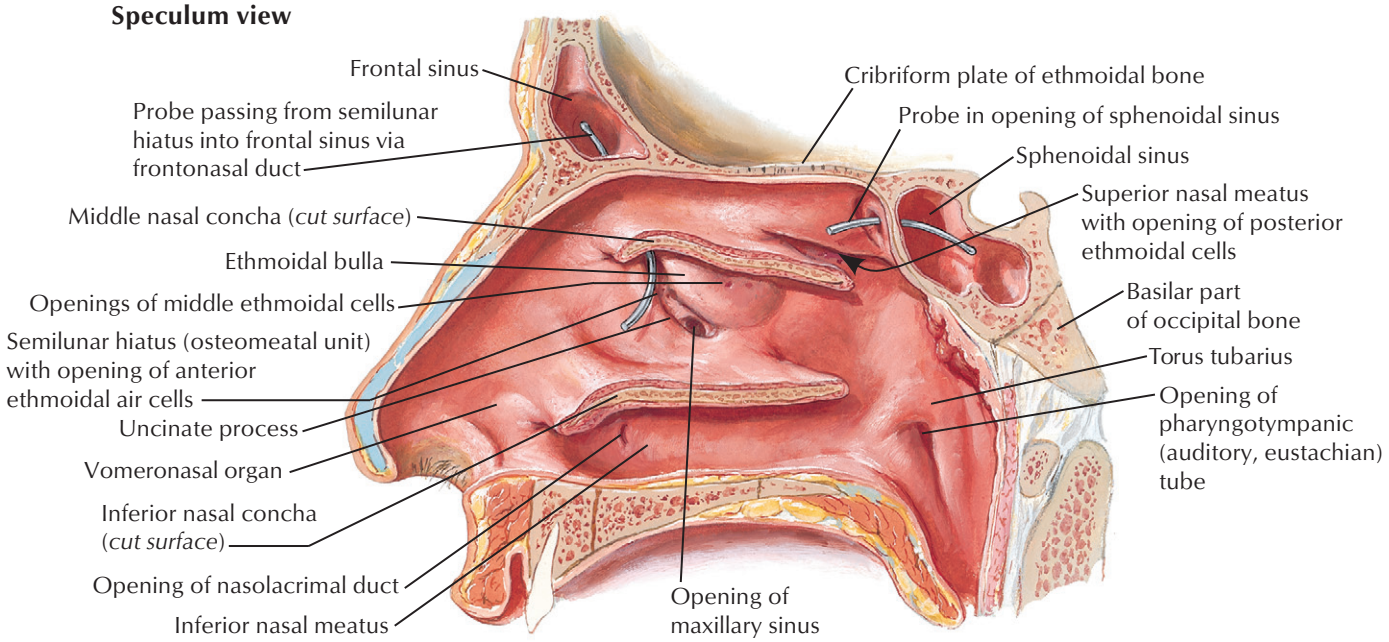


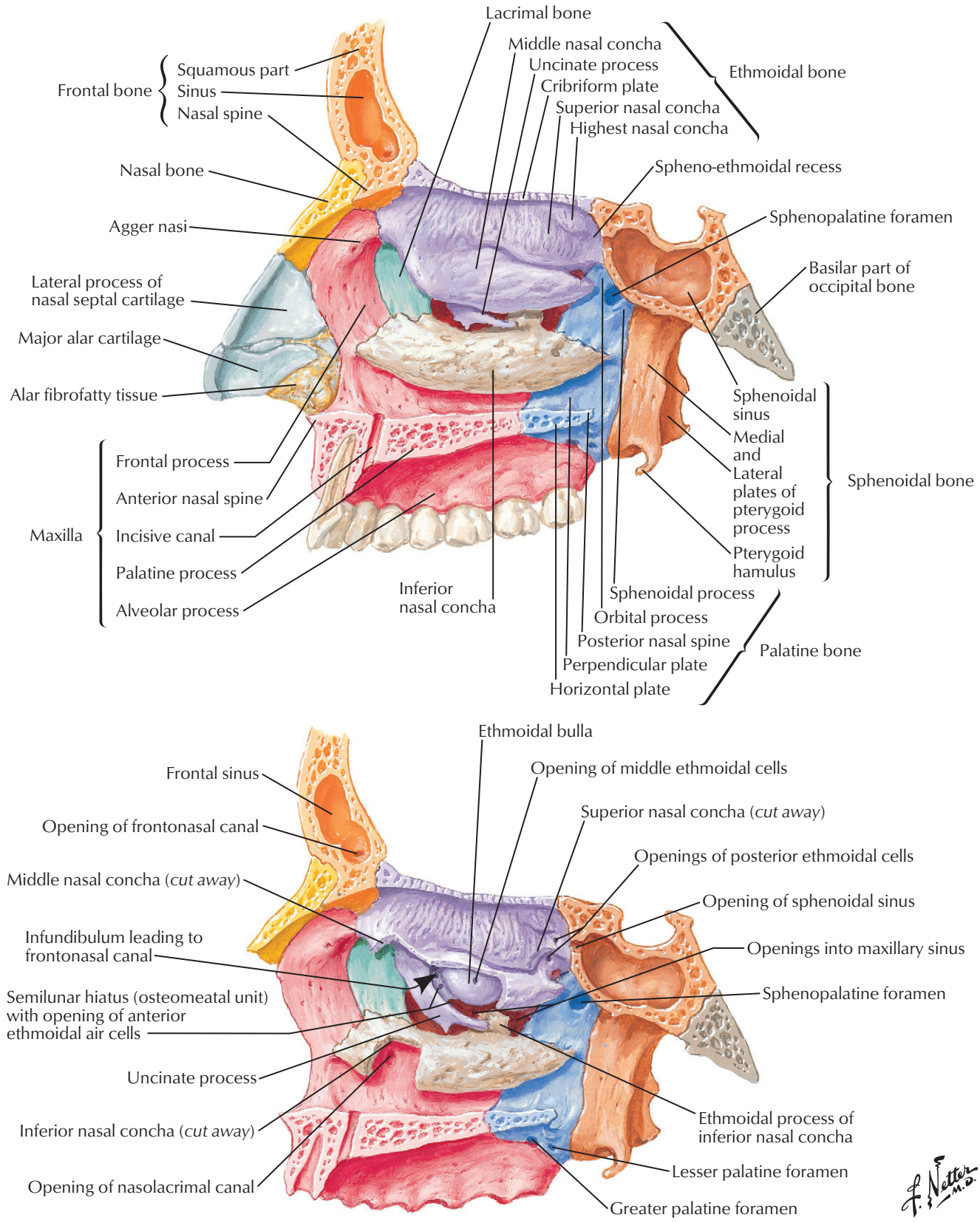
Lateral Wall of Nasal Cavity





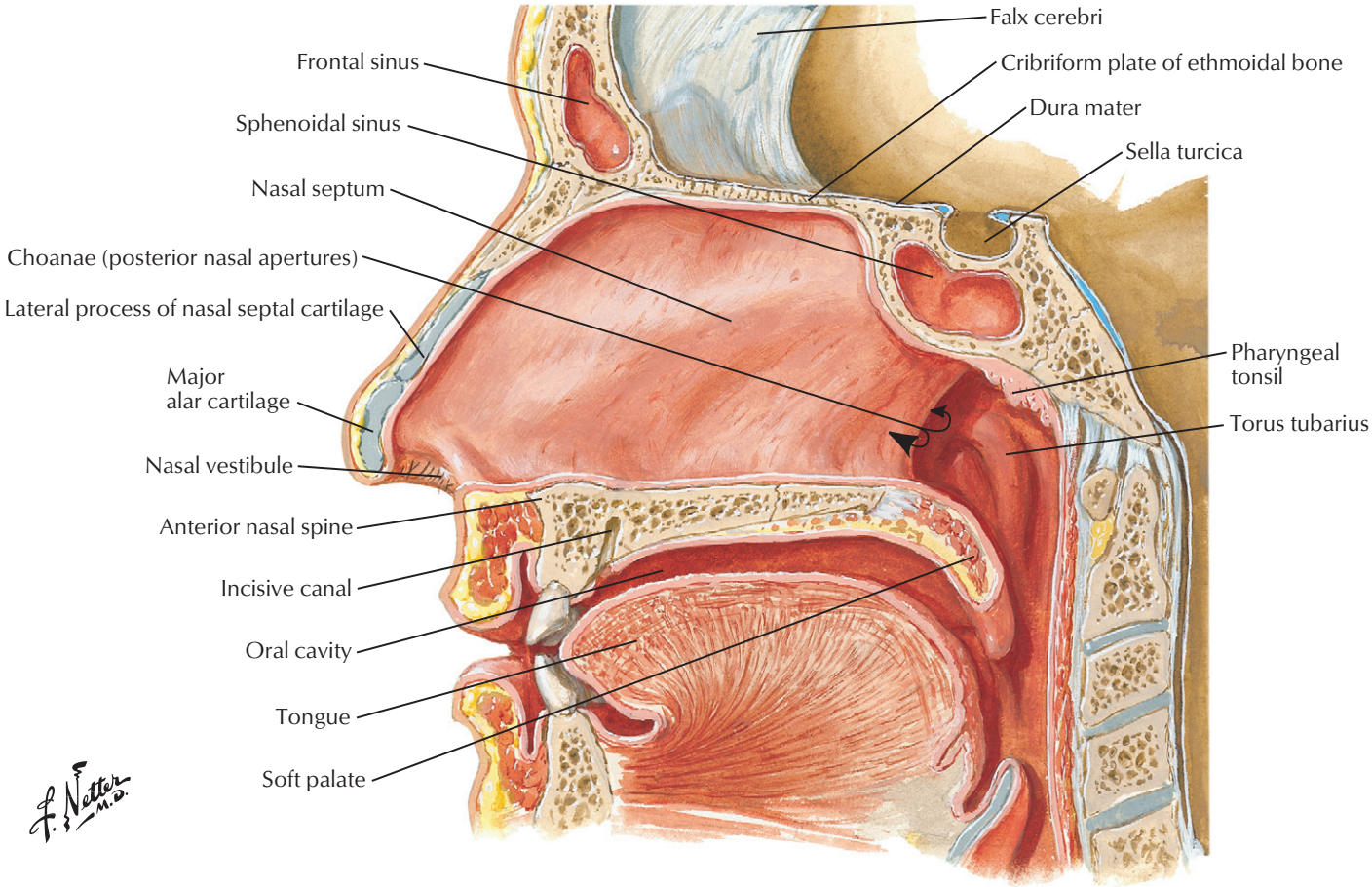
Speculum view

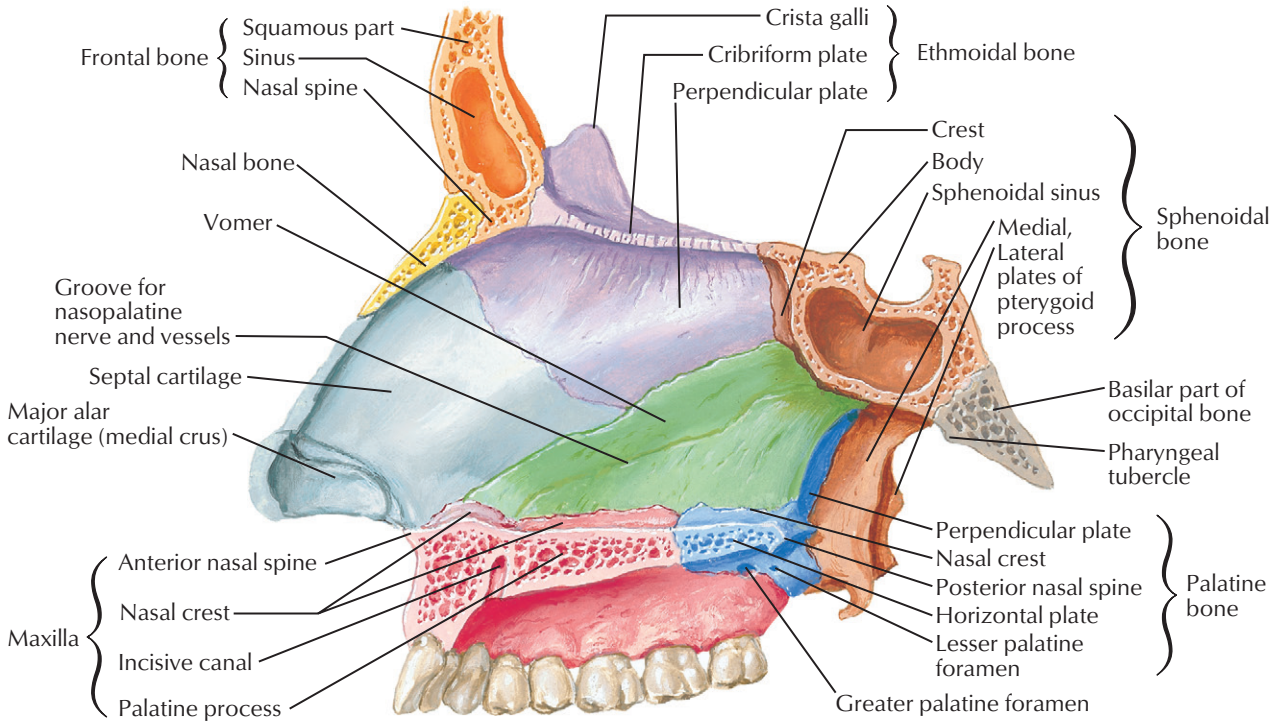



Lacrimal bone
Middle nasal concha
Uncinate process
Cribriform plate
Superior nasal concha
Highest nasal concha
Ethmoidal bone
Frontal bone
Squamous part
Sinus
Nasal spine
Nasal bone
Spheno-ethmoidal recess
Agger nasi
Sphenopalatine foramen
Lateral process of nasal septal cartilage
Basilar part of occipital bone
Major alar cartilage
Alar fibrofatty tissue
Sphenoidal sinus
Medial and Lateral plates of pterygoid process
Sphenoidal bone
Pterygoid hamulus
Frontal process
Anterior nasal spine
Maxilla
Incisive canal
Palatine process
Alveolar process
Inferior nasal concha
Sphenoidal process
Orbital process
Posterior nasal spine
Perpendicular plate
Palatine bone
Horizontal plate
Ethmoidal bulla
Frontal sinus
Opening of middle ethmoidal cells
Opening of frontonasal canal
Superior nasal concha (cut away)
Openings of posterior ethmoidal cells
Middle nasal concha (cut away)
Opening of sphenoidal sinus
Infundibulum leading to frontonasal canal
Openings into maxillary sinus
Semilunar hiatus (osteomeatal unit) with opening of anterior ethmoidal air cells
Sphenopalatine foramen
Uncinate process
Ethmoidal process of inferior nasal concha
Inferior nasal concha (cut away)
Lesser palatine foramen
Opening of nasolacrimal canal
Greater palatine foramen

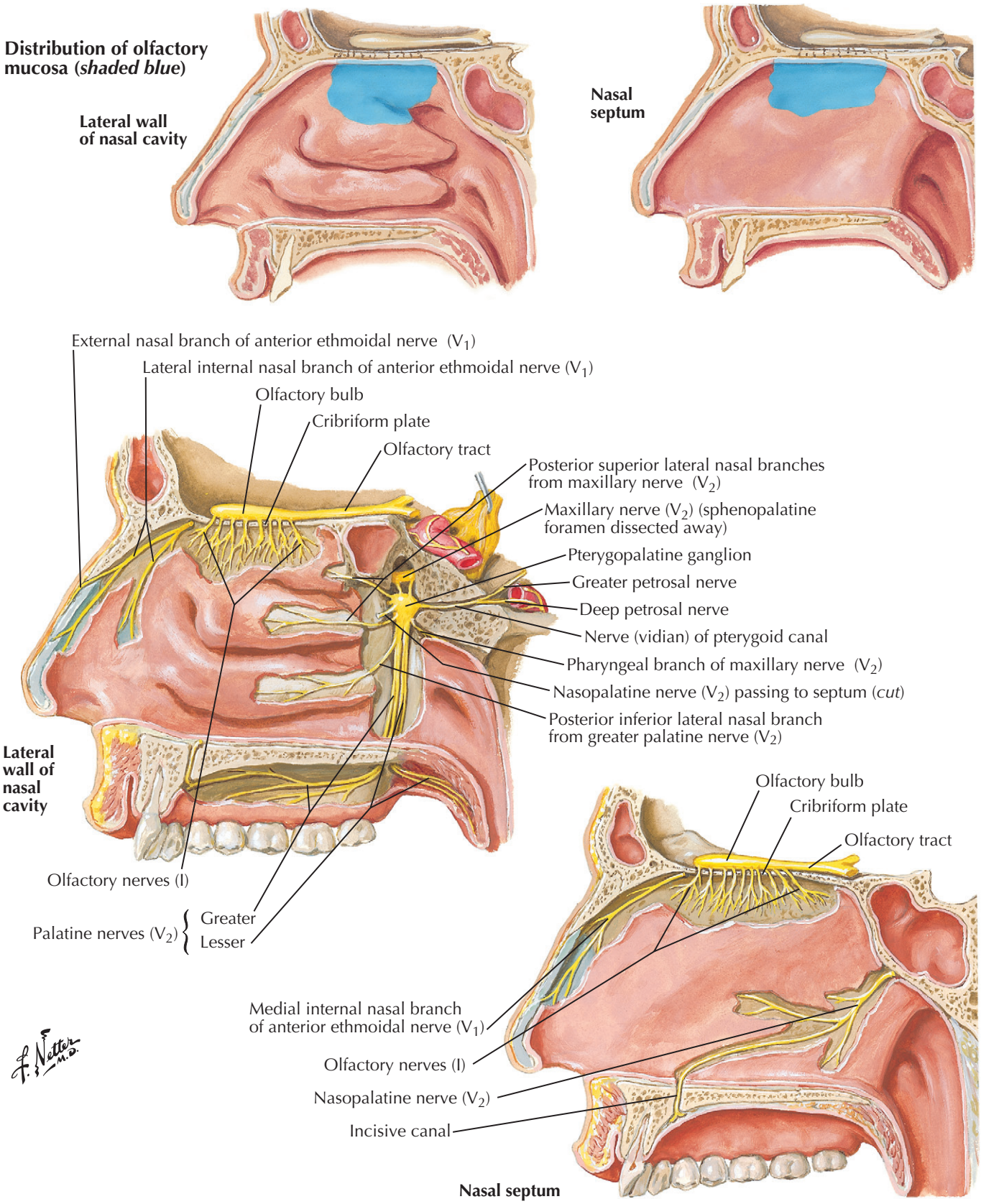
Medial Wall of Nasal Cavity (Nasal Septum)

See also **Plate 8**



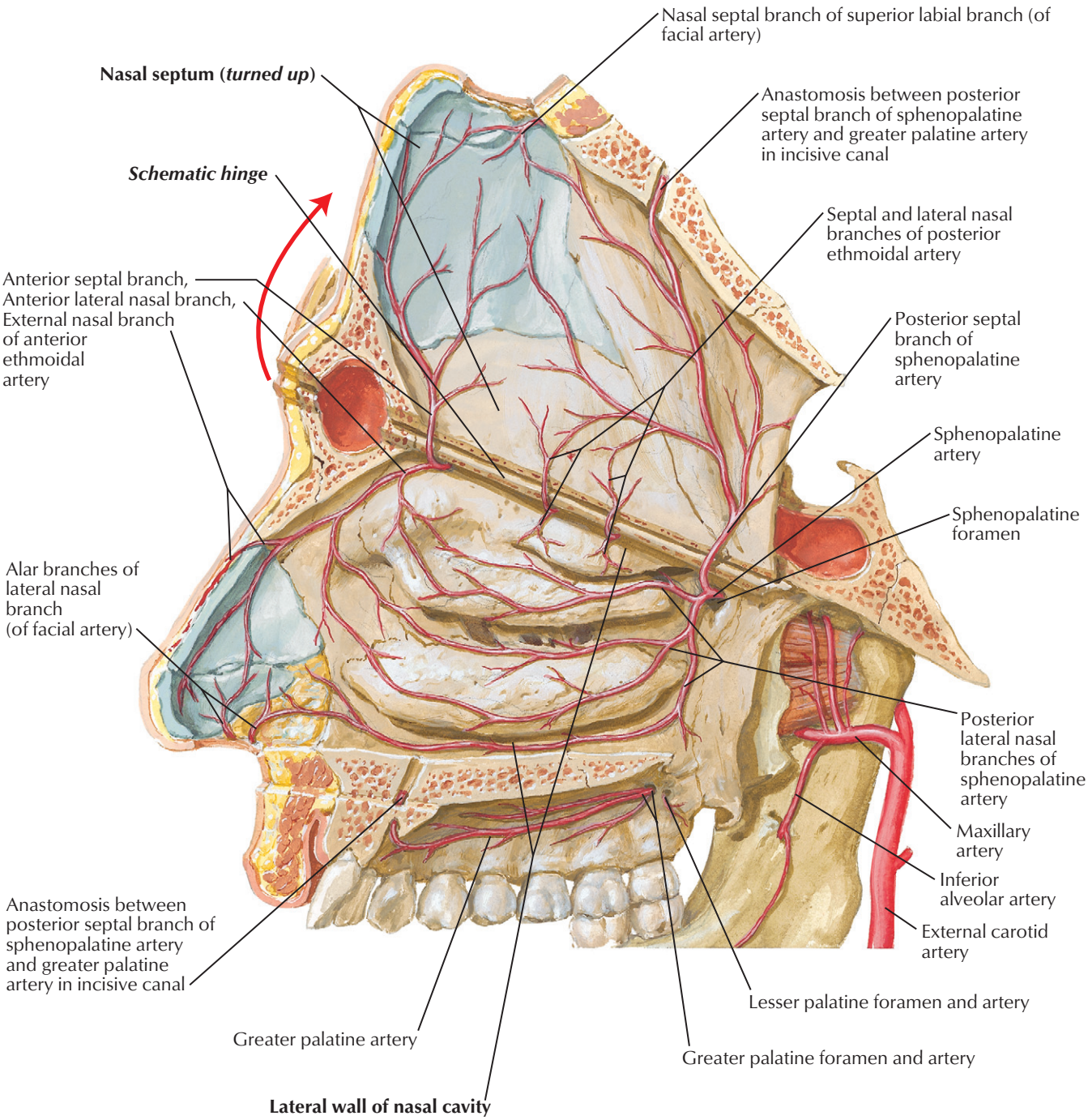


See also Plates 54, 62, 120



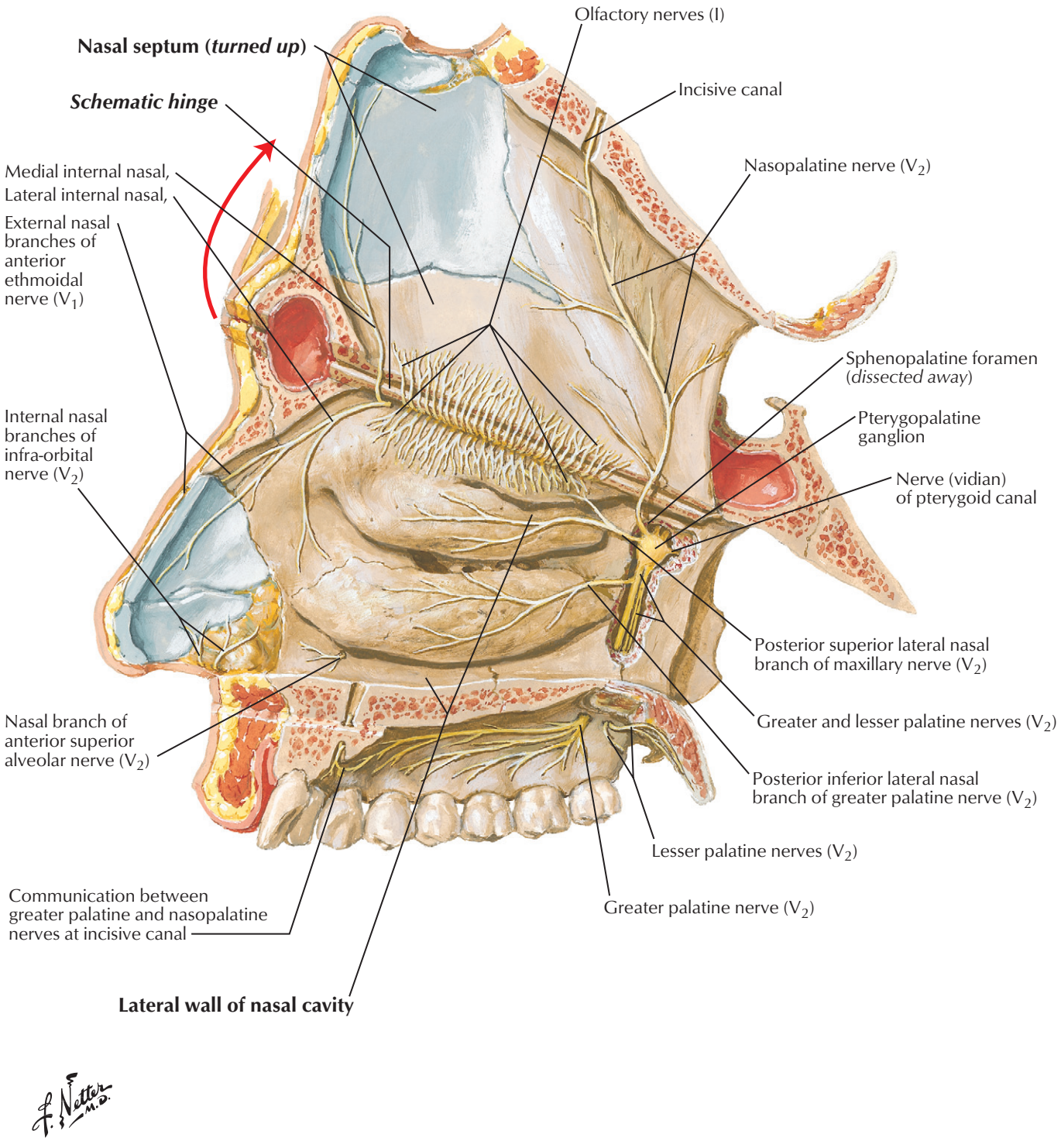
Arteries of Nasal Cavity: Nasal Septum Turned Up

See also Plate 57

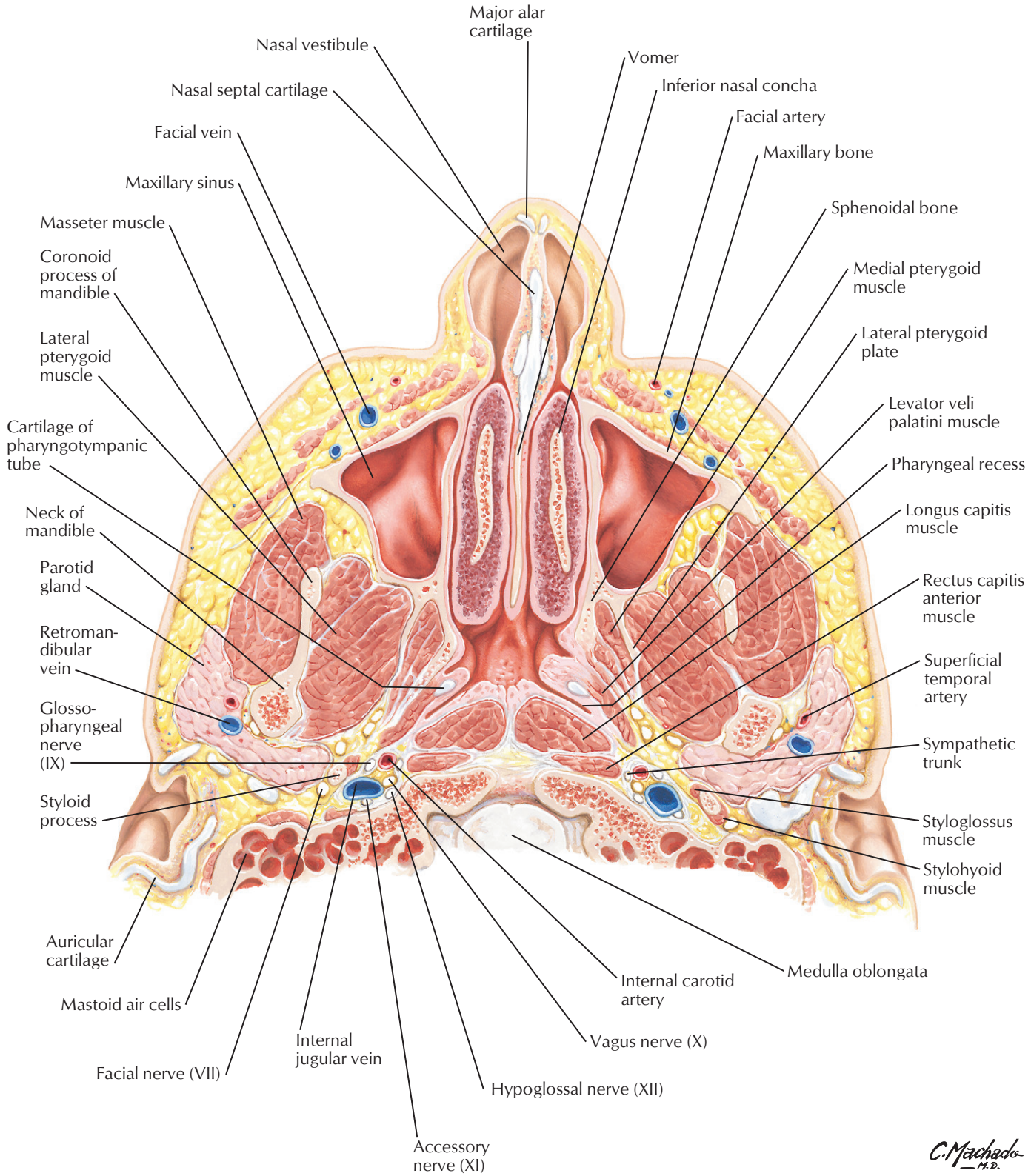


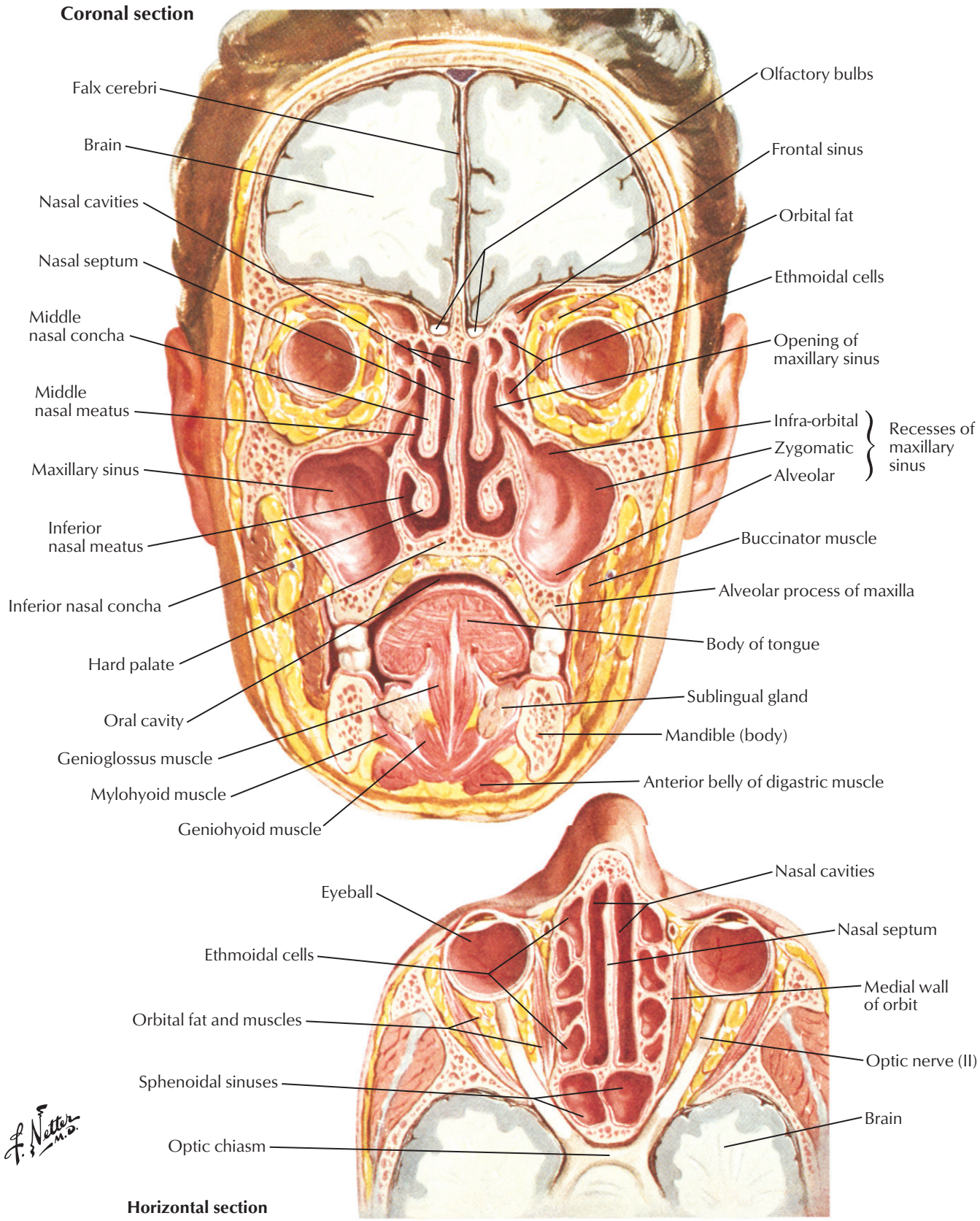
Nerves of Nasal Cavity: Nasal Septum Turned Up

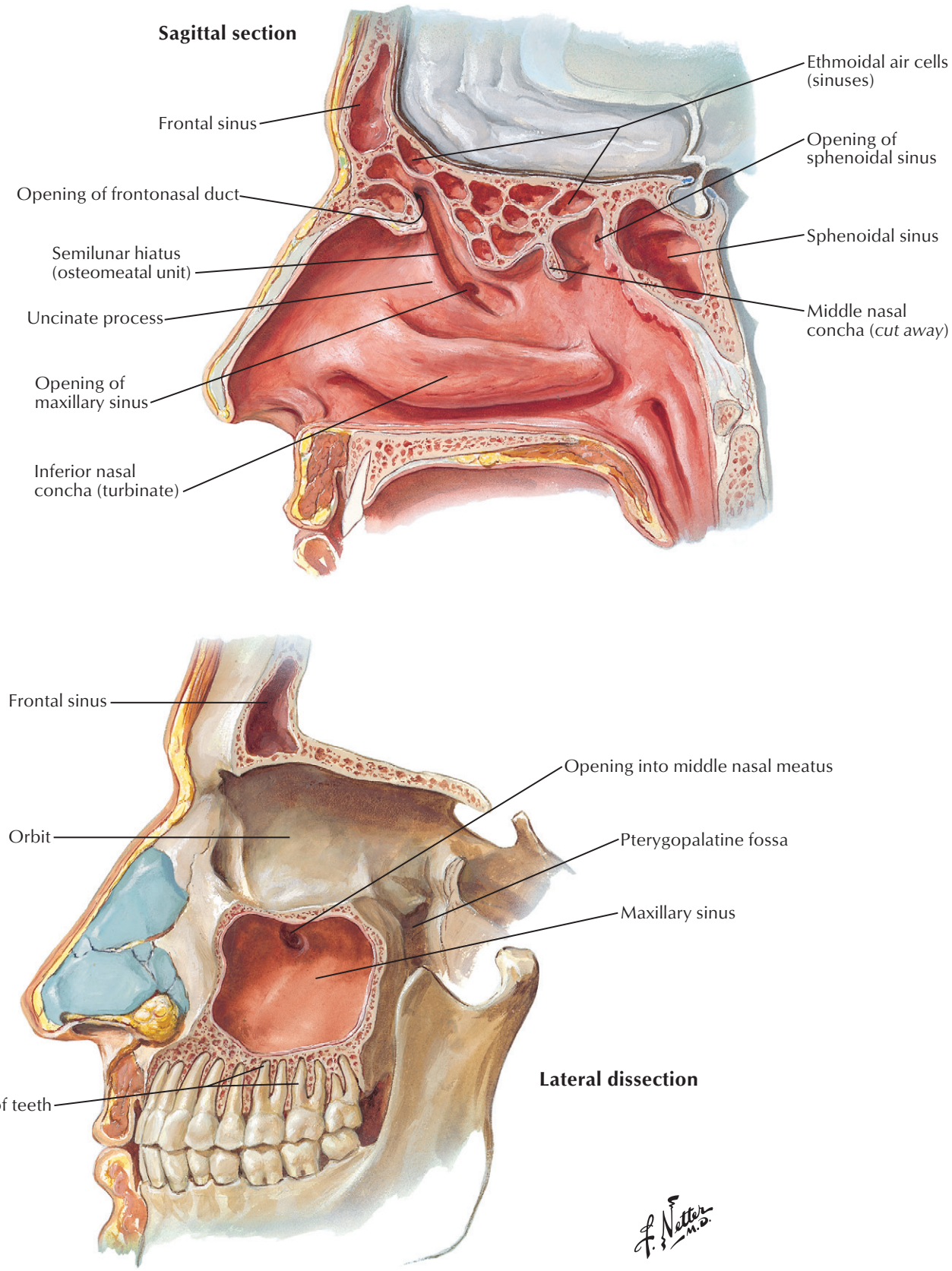
See also Plates 52, 53



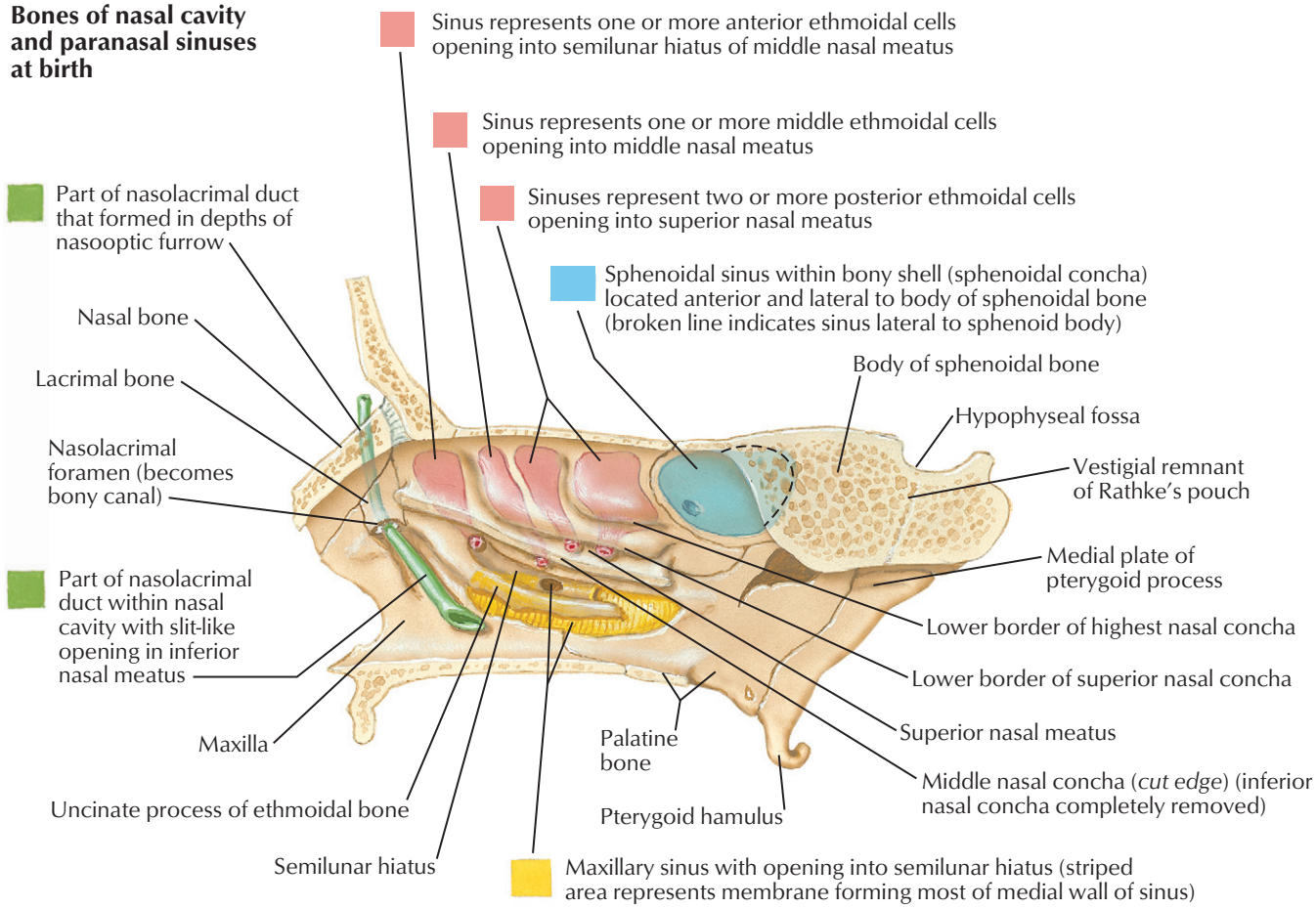
Nose and Maxillary Sinus: Transverse Section



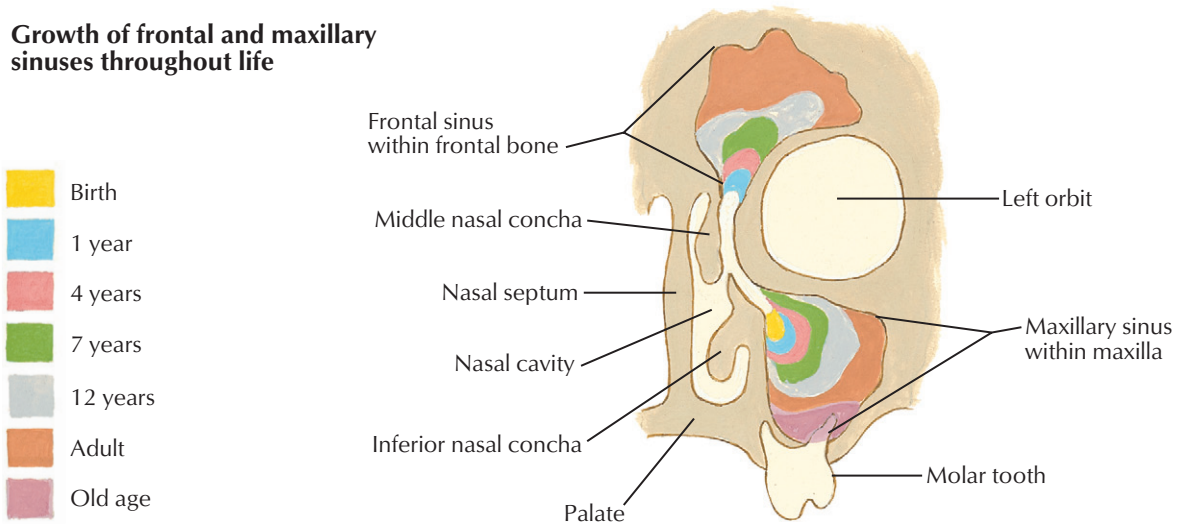

Coronal section
Falx cerebri
Brain
Nasal cavities
Nasal septum
Middle nasal concha
Middle nasal meatus
Maxillary sinus
Inferior nasal meatus
Inferior nasal concha
Hard palate
Oral cavity
Genioglossus muscle
Mylohyoid muscle
Geniohyoid muscle
Olfactory bulbs
Frontal sinus
Orbital fat
Ethmoidal cells
Opening of maxillary sinus
Infra-orbital
Zygomatic
Alveolar
Recesses of maxillary sinus
Buccinator muscle
Alveolar process of maxilla
Body of tongue
Sublingual gland
Mandible (body)
Anterior belly of digastric muscle
Eyeball
Ethmoidal cells
Orbital fat and muscles
Sphenoidal sinuses
Optic chiasm
Nasal cavities
Nasal septum
Medial wall of orbit
Optic nerve (II)
Brain
Horizontal section


Sagittal section
Ethmoidal air cells (sinuses)
Frontal sinus
Opening of sphenoidal sinus
Opening of frontonasal duct
Sphenoidal sinus
Semilunar hiatus (osteomeatal unit)
Middle nasal concha (cut away)
Uncinate process
Opening of maxillary sinus
Inferior nasal concha (turbinate)
Frontal sinus
Opening into middle nasal meatus
Orbit
Pterygopalatine fossa
Maxillary sinus
Roots of teeth
Lateral dissection

Bones of nasal cavity and paranasal sinuses at birth



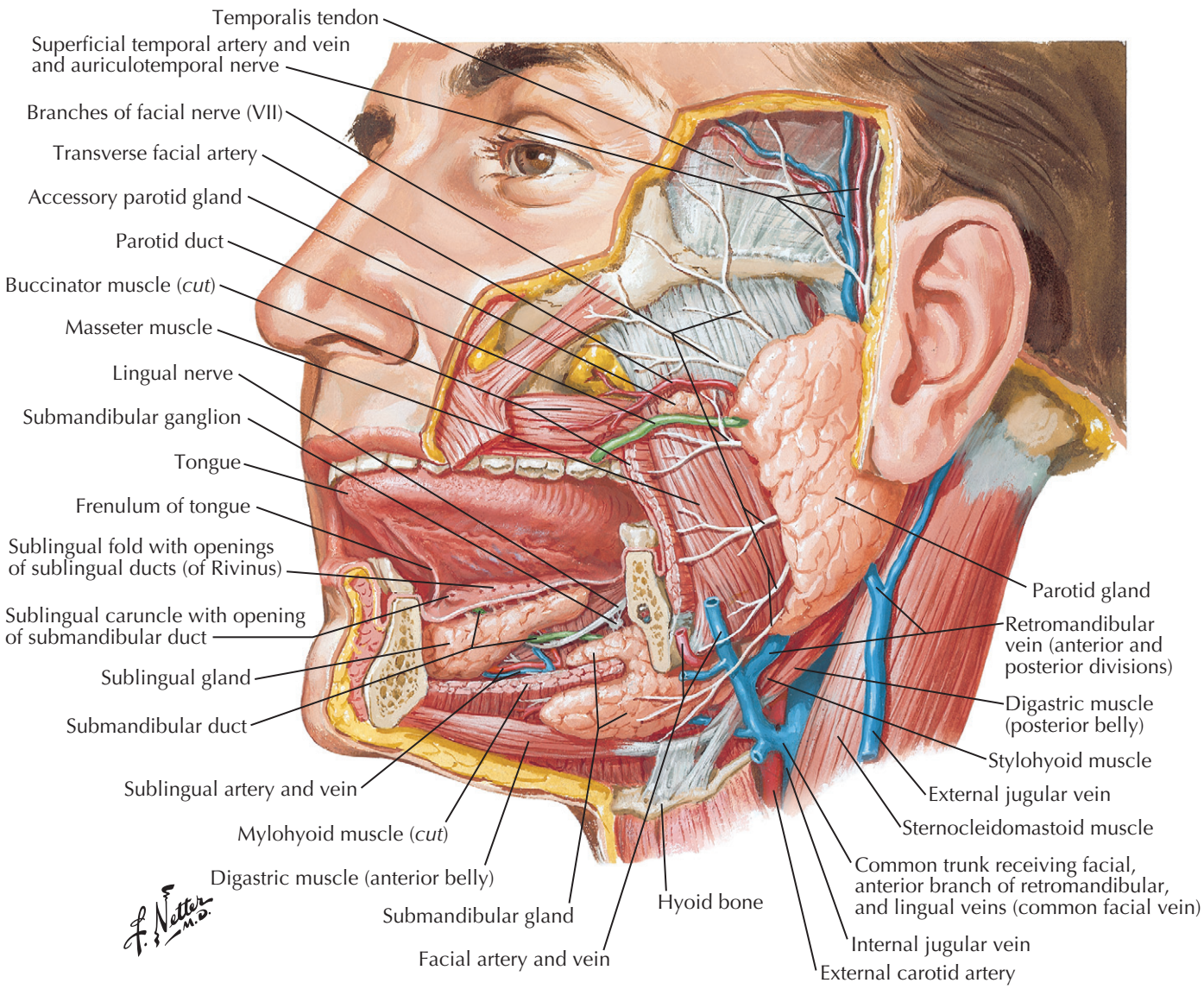
Growth of frontal and maxillary sinuses throughout life



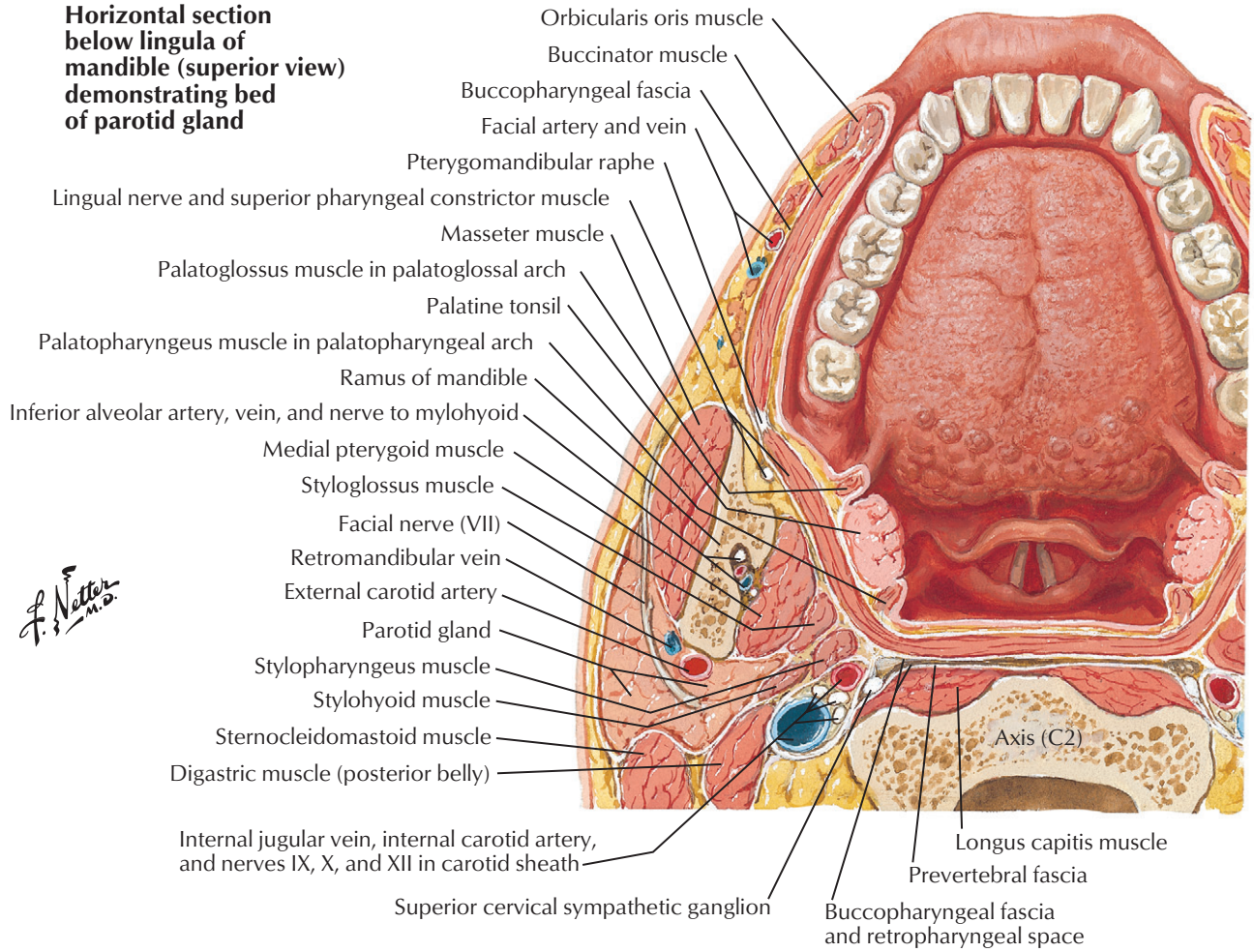
F. Netter M.D.

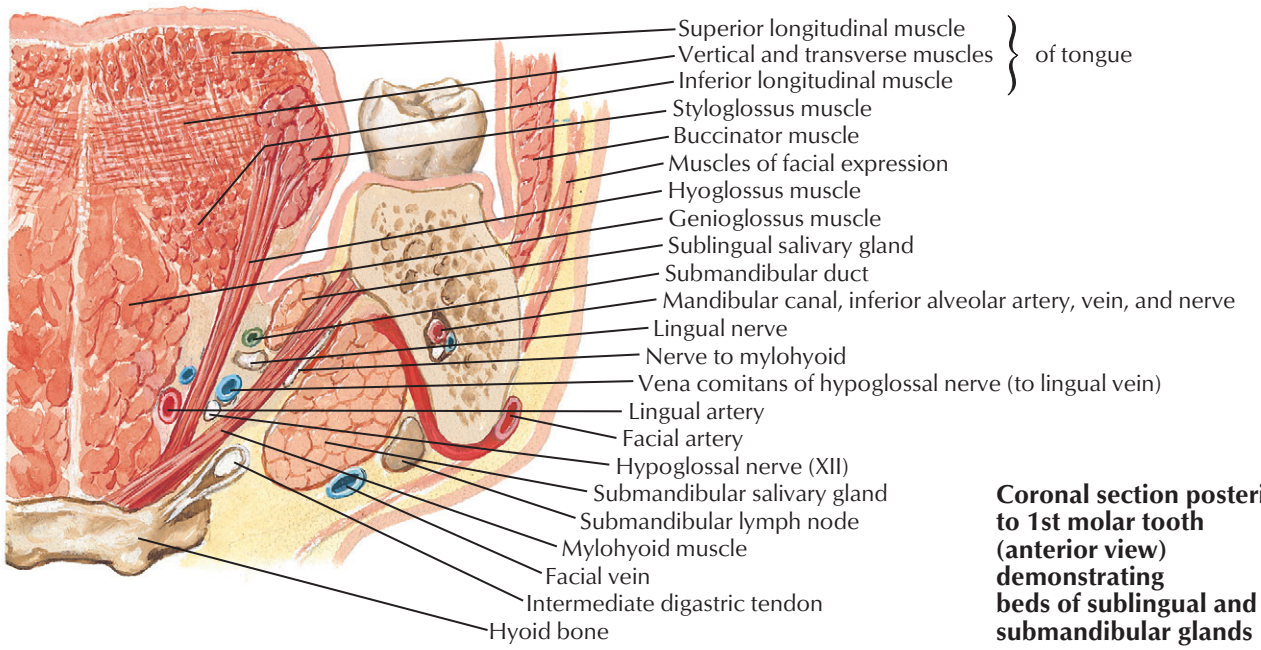
Salivary Glands

See also Plates 24, 134, 135



Horizontal section below lingula of mandible (superior view) demonstrating bed of parotid gland

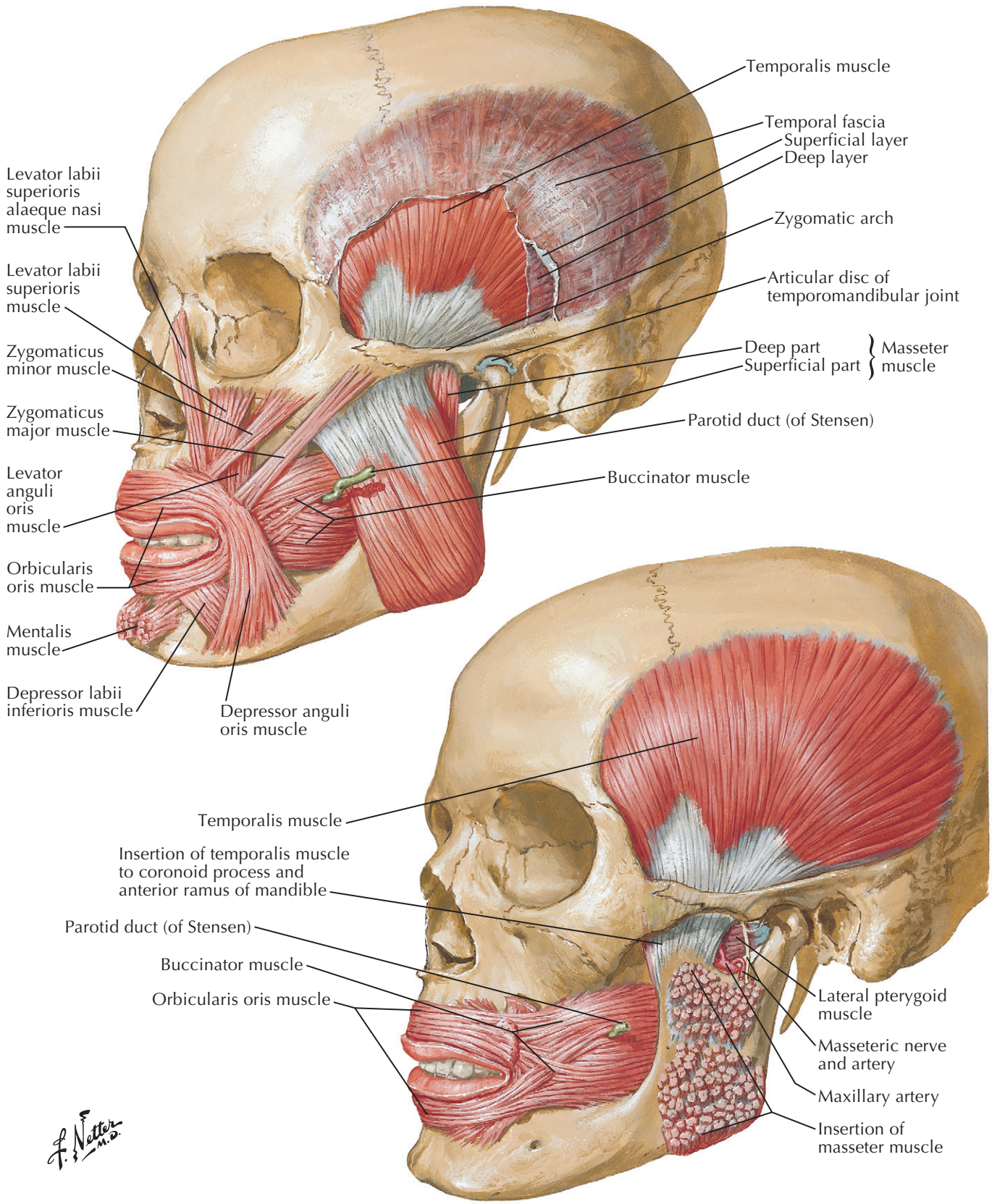


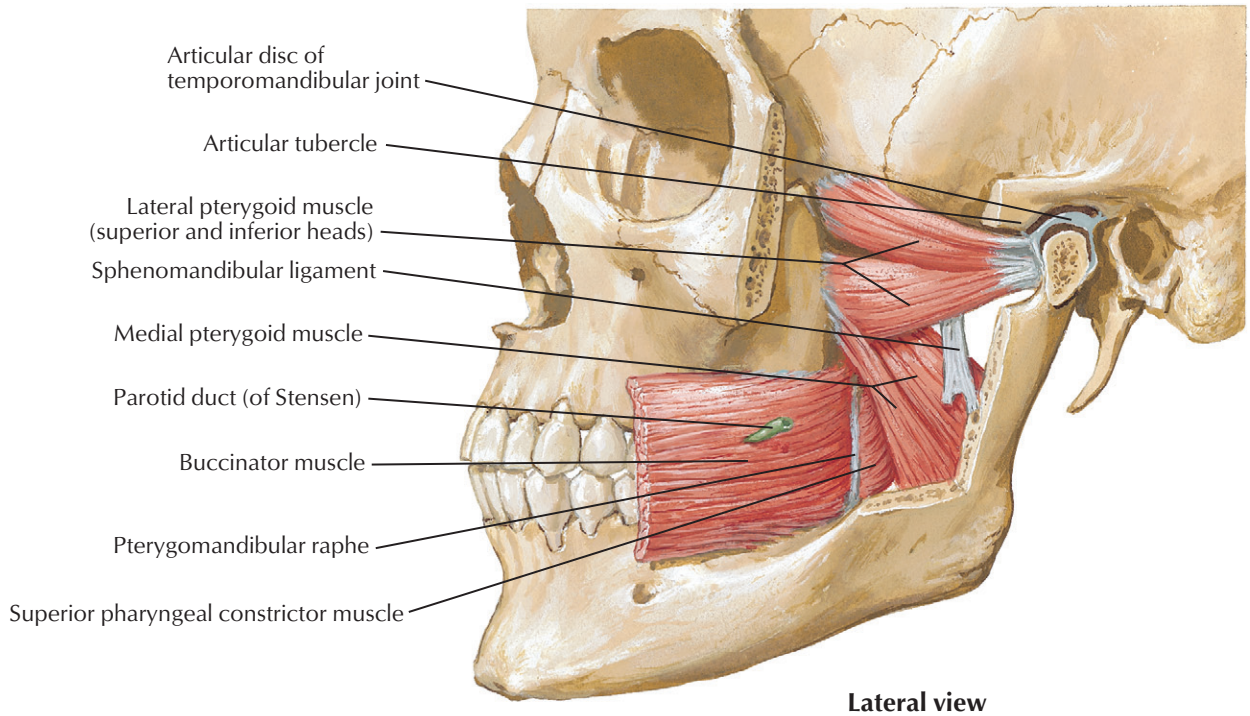


Coronal section posterior to 1st molar tooth (anterior view) demonstrating beds of sublingual and submandibular glands

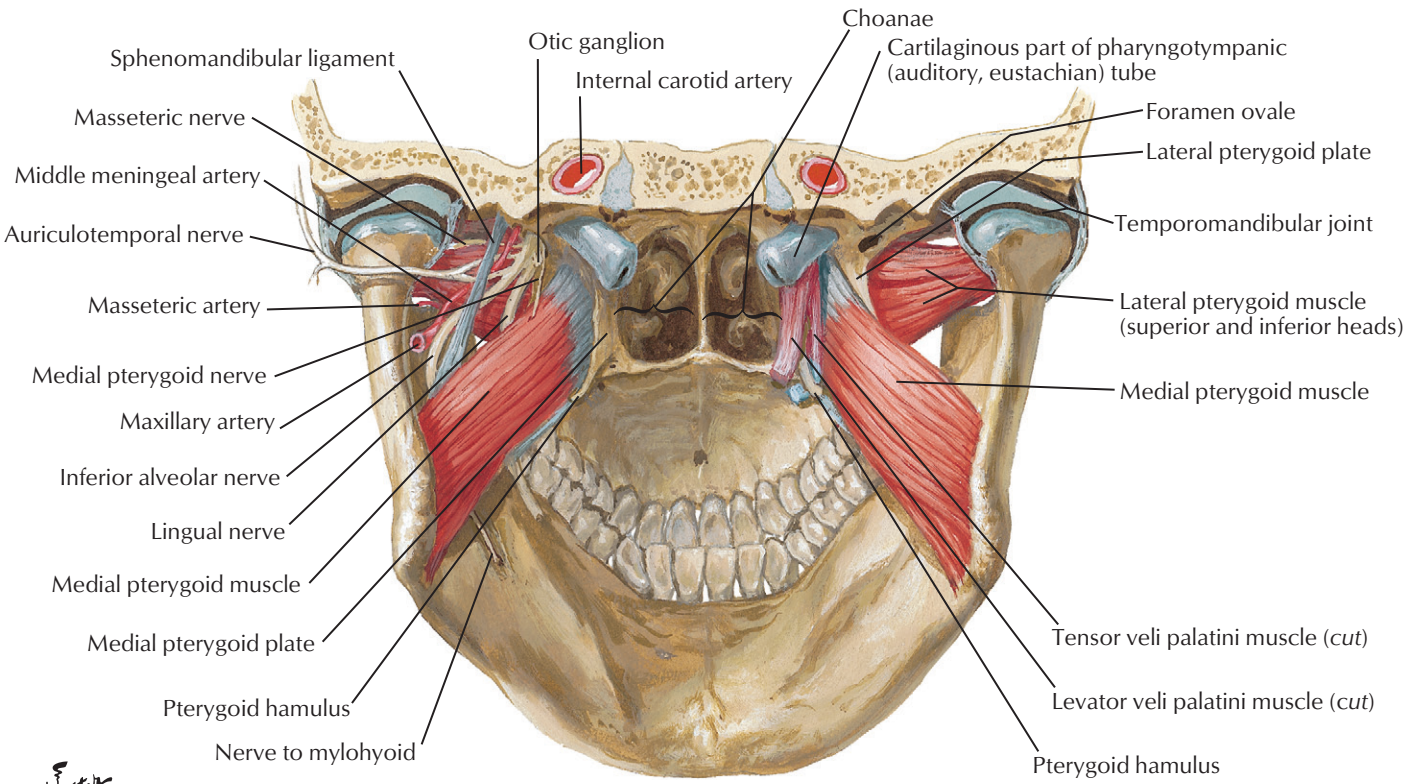
Muscles Involved in Mastication

For facial muscles see Plate 25





Lateral view

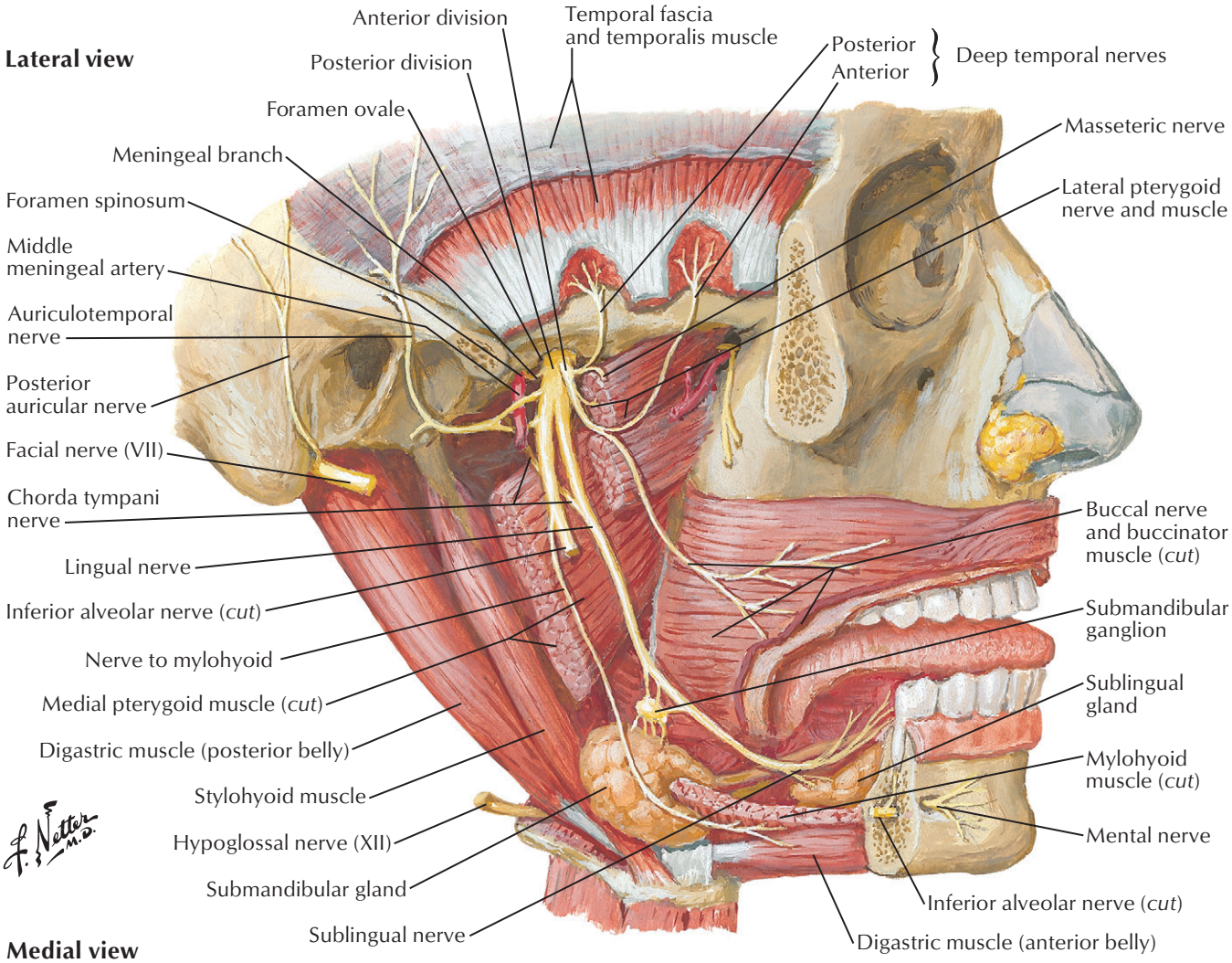


Posterior view

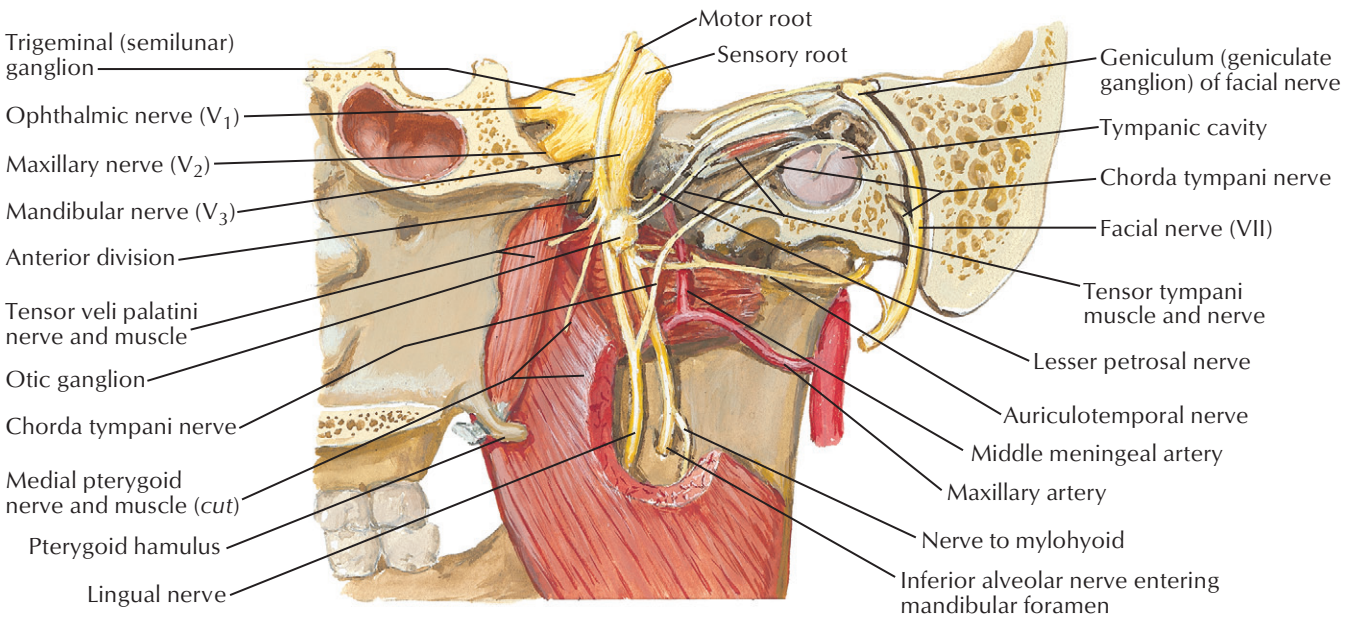
Mandibular Nerve (V_3)

See also Plates 71, 123

Lateral view

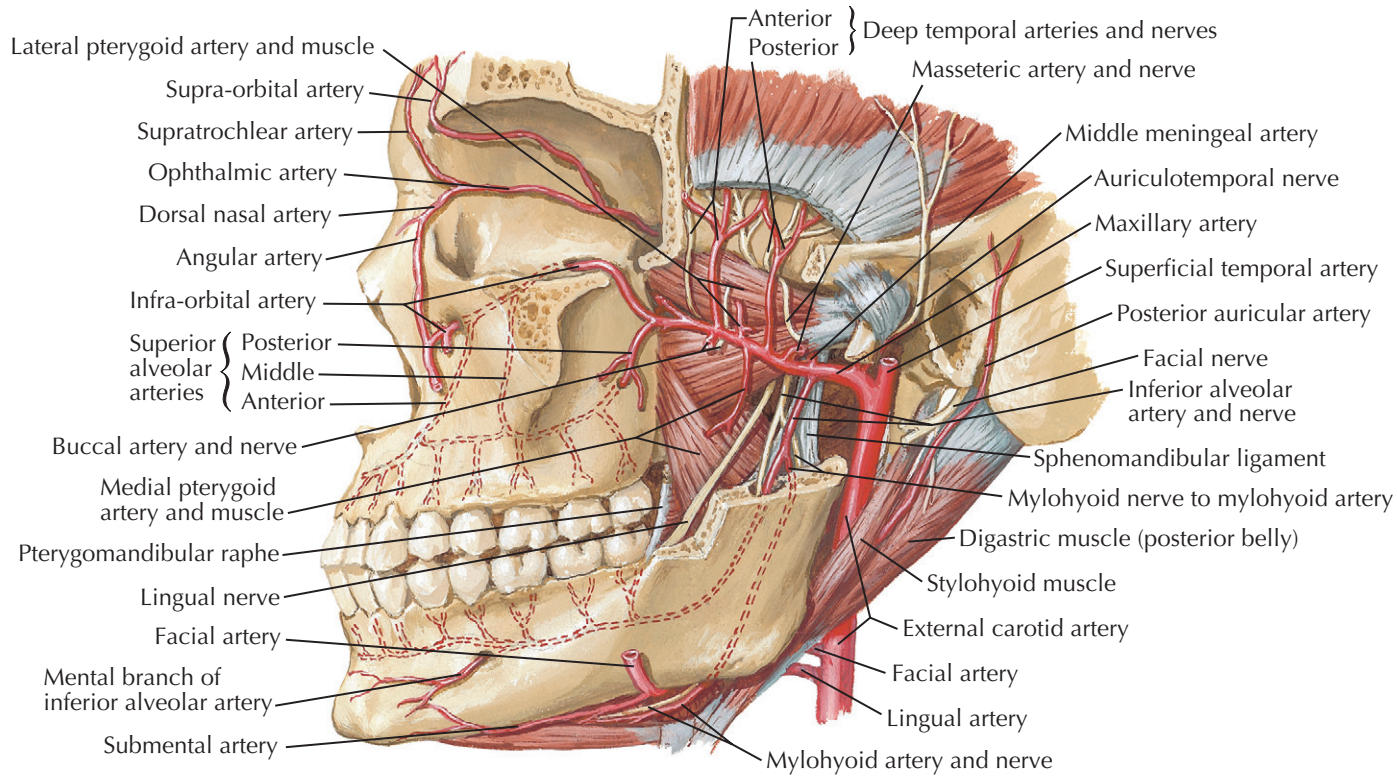


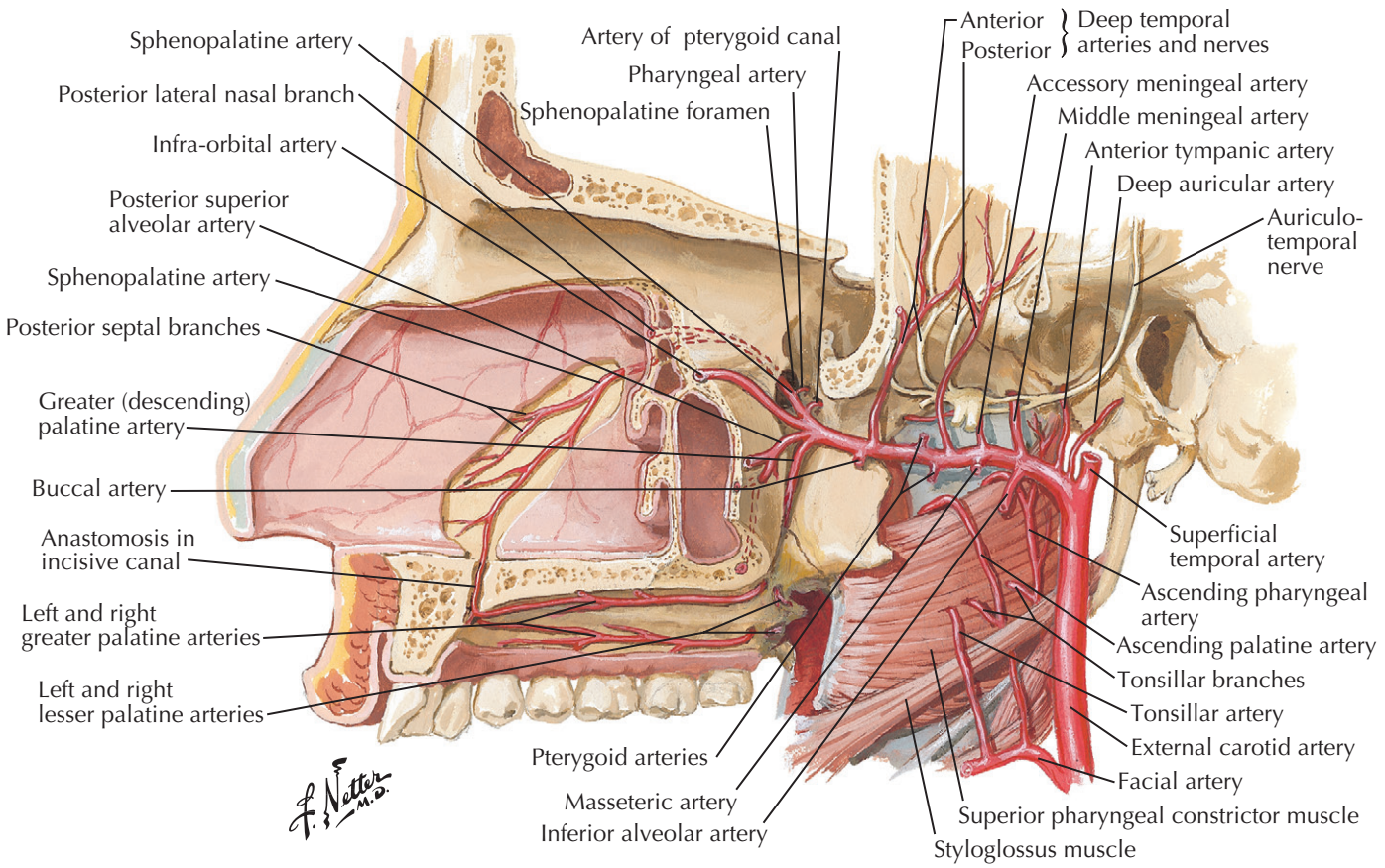
Medial view



Maxillary Artery

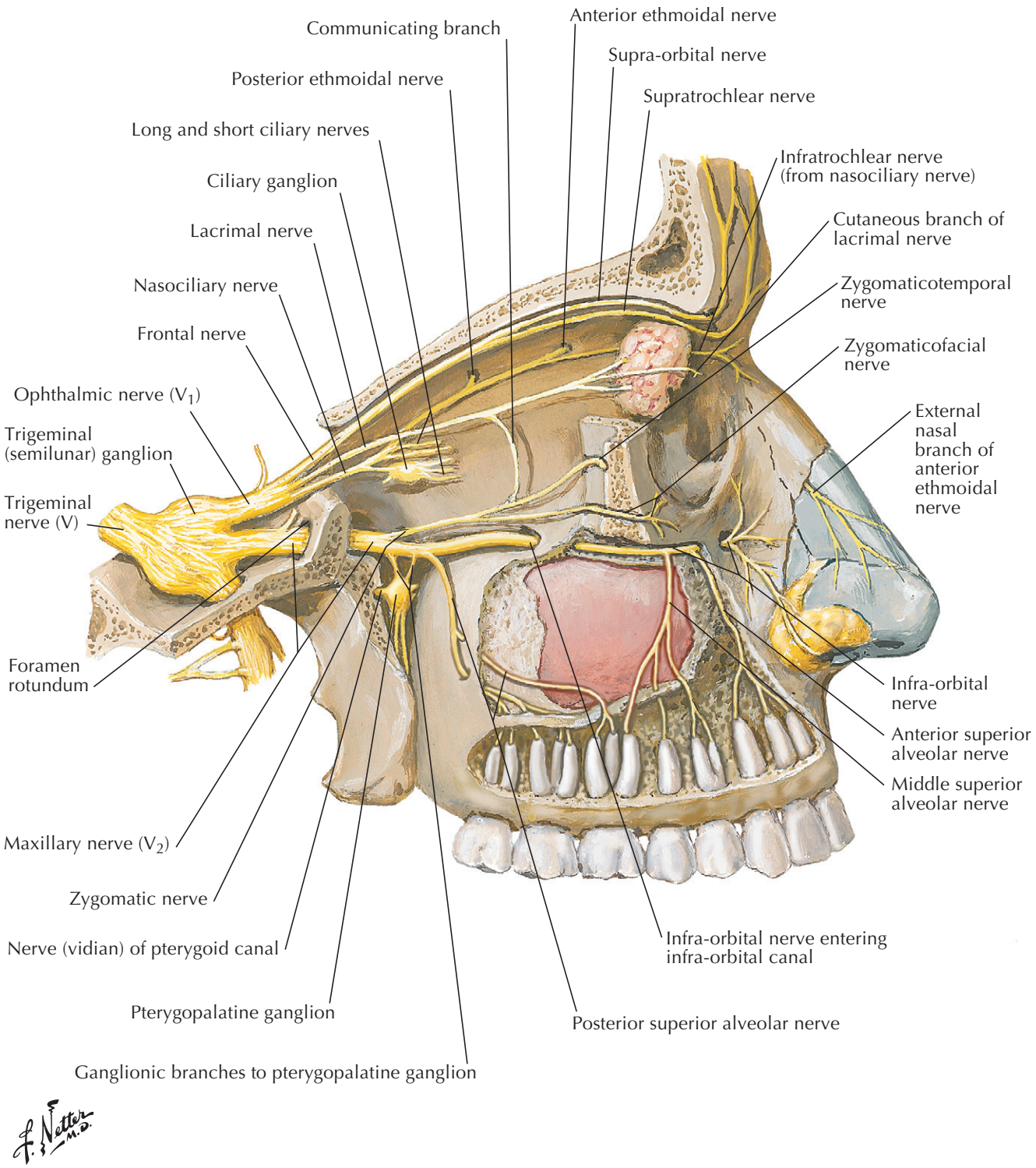
See also Plates 34, 72





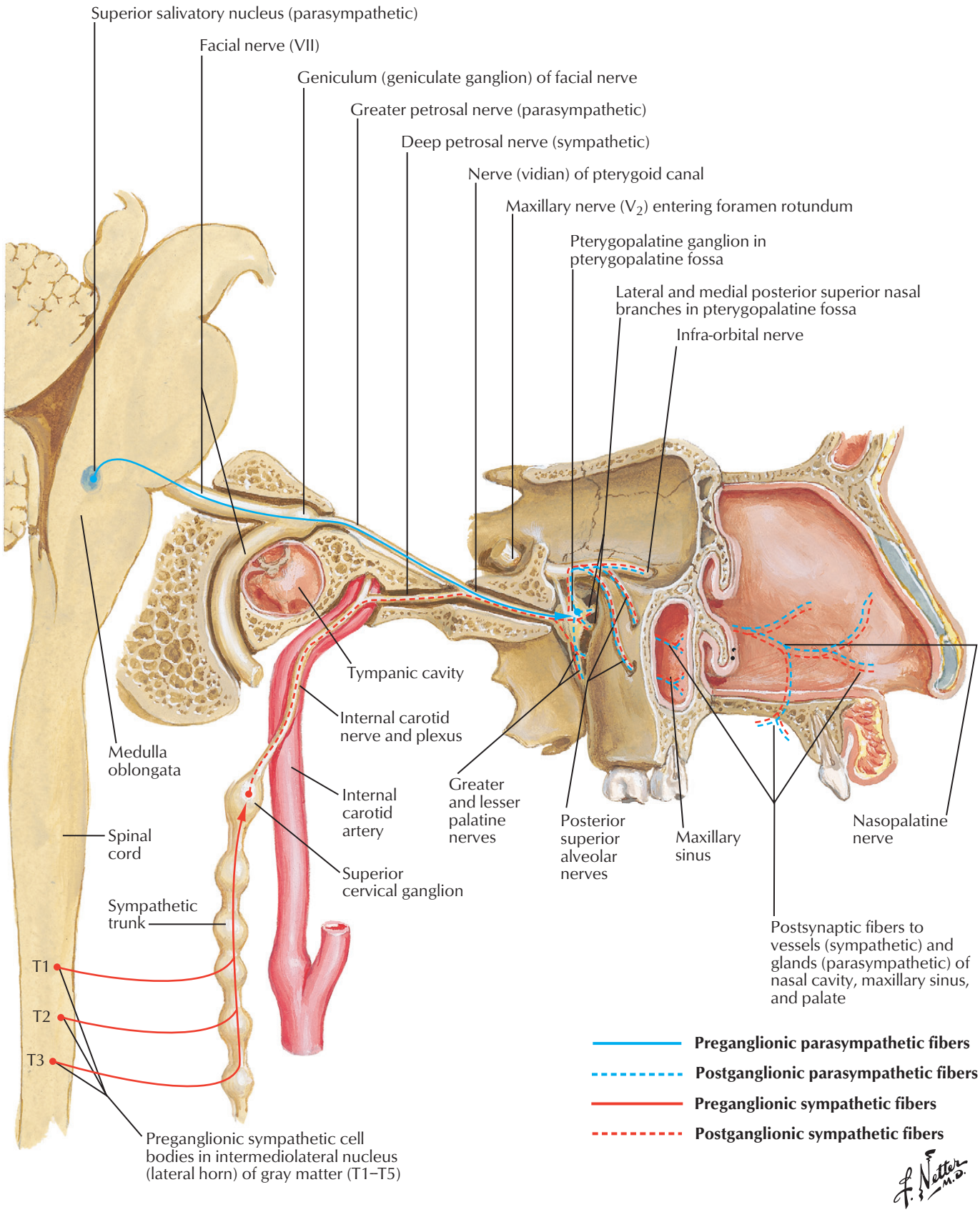
Ophthalmic (V_1) and Maxillary (V_2) Nerves

See also **Plate 44**



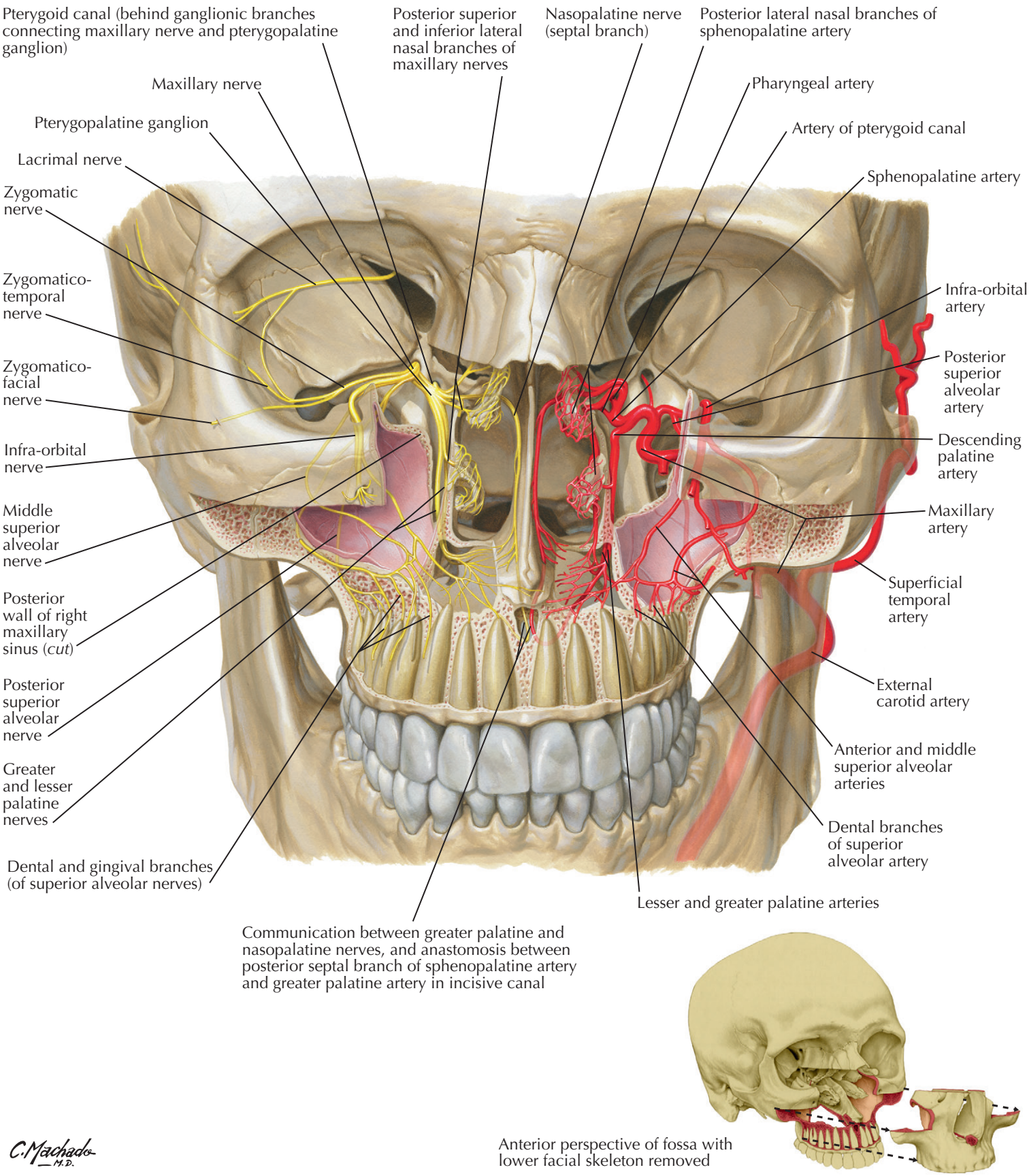
Autonomic Innervation of Nasal Cavity

See also Plates 123, 132, 134



Pterygopalatine Fossa

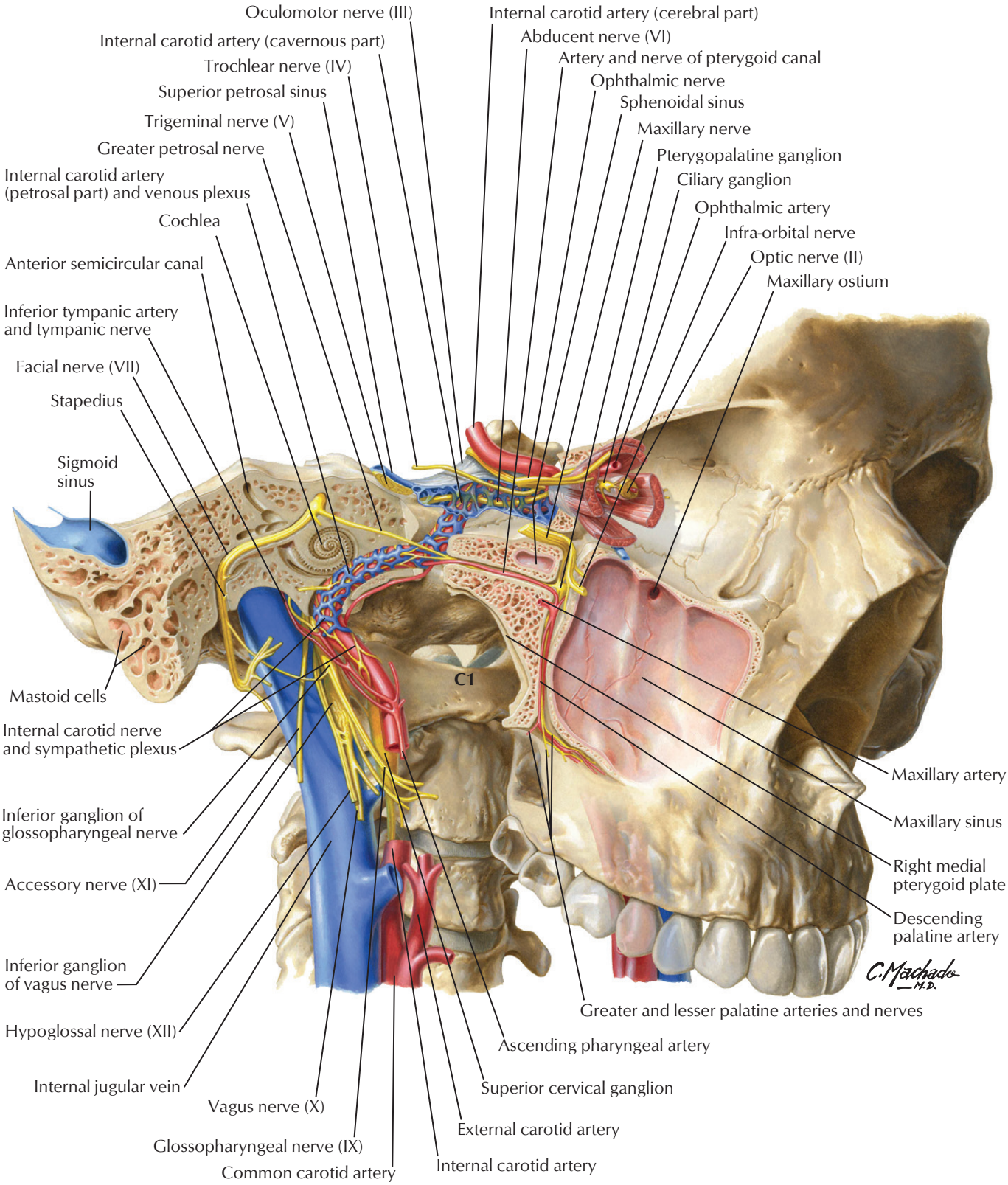
See also Plates 39, 41, 52

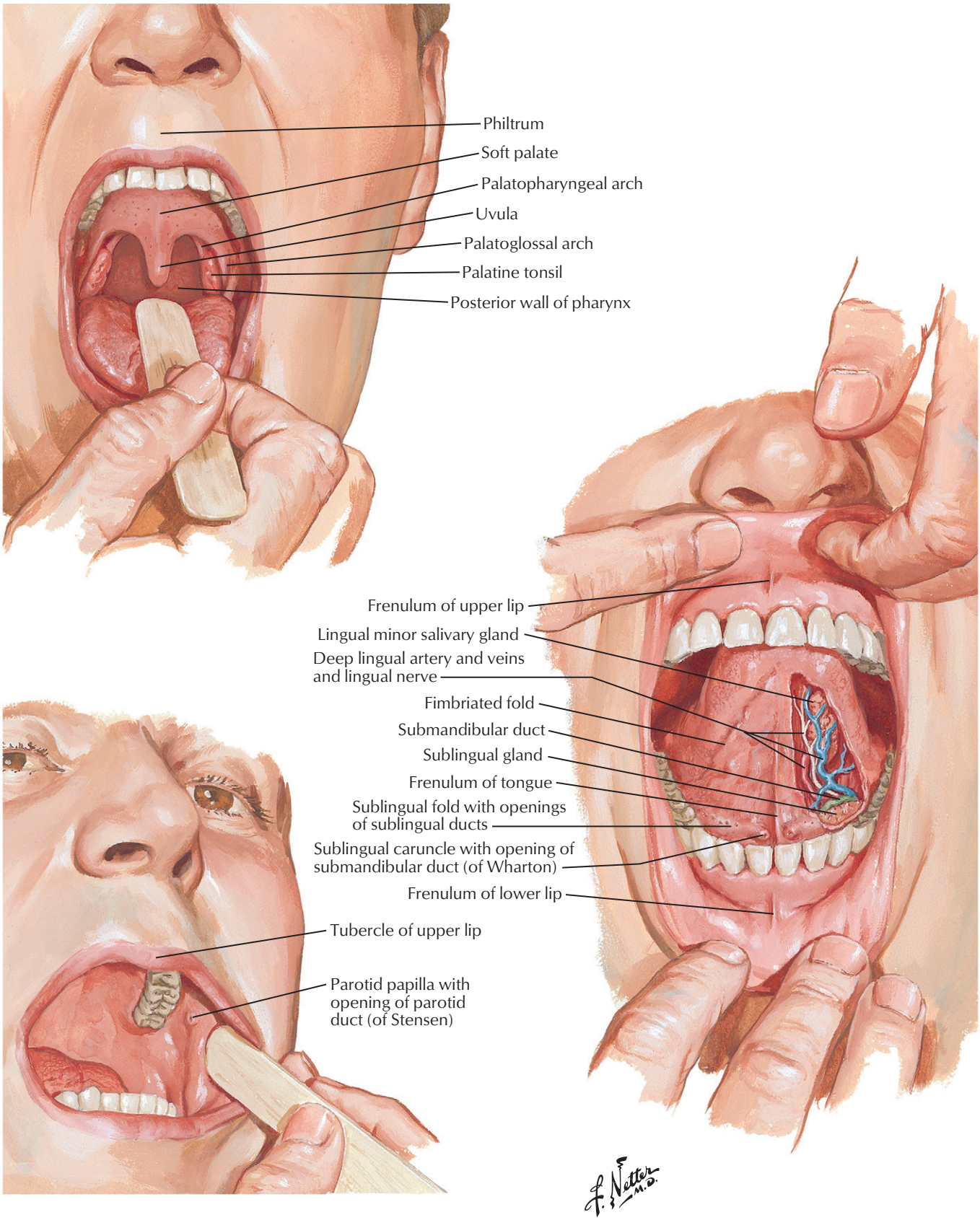


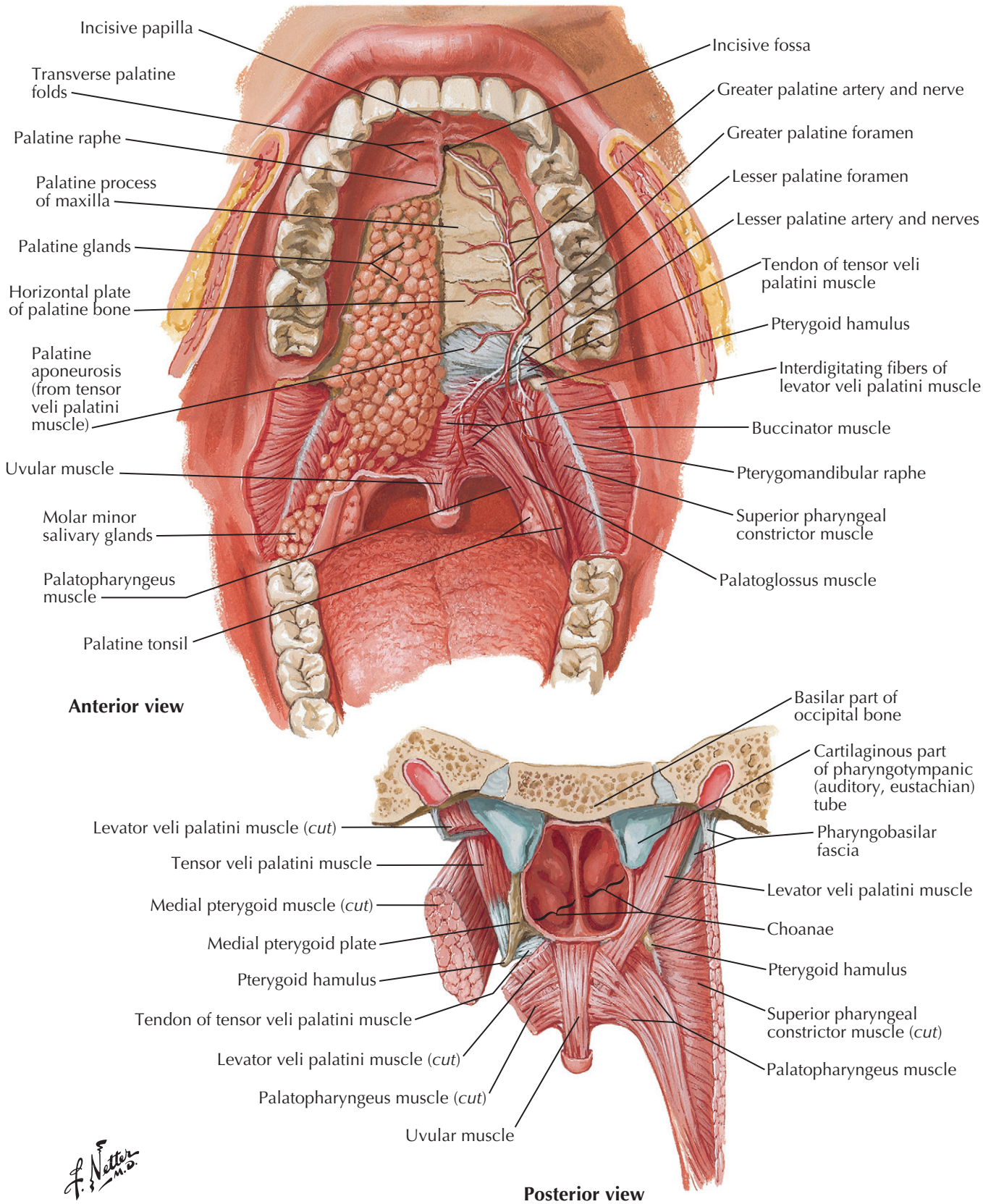
Anterior perspective of fossa with lower facial skeleton removed

Orientation of Nerves and Vessels of the Cranial Base

See also Plates 105, 132, 137



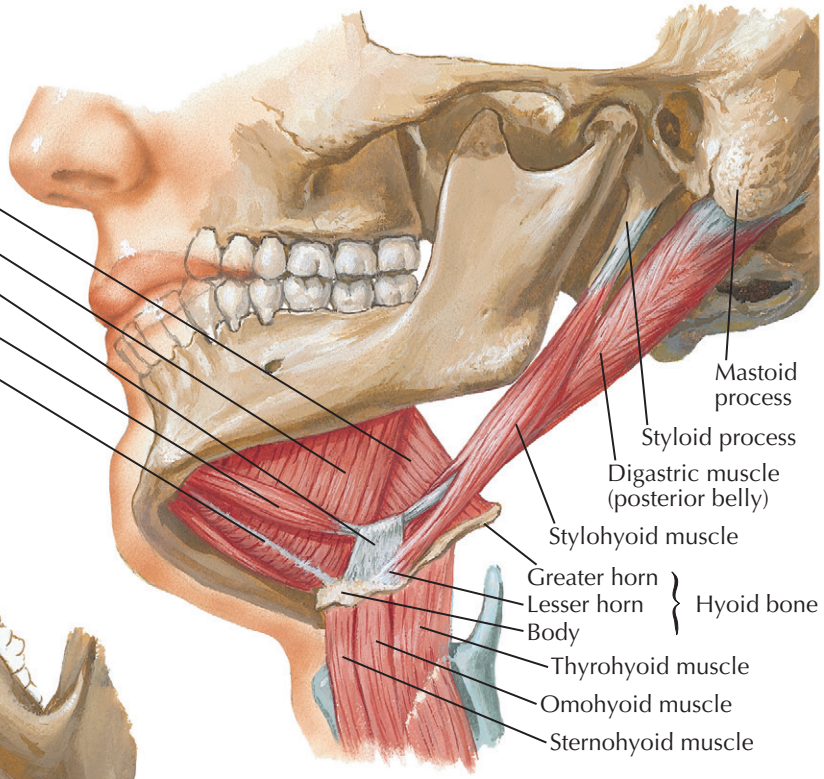

Philtrum
Soft palate
Palatopharyngeal arch
Uvula
Palatoglossal arch
Palatine tonsil
Posterior wall of pharynx
Frenulum of upper lip
Lingual minor salivary gland
Deep lingual artery and veins and lingual nerve
Fimbriated fold
Submandibular duct
Sublingual gland
Frenulum of tongue
Sublingual fold with openings of sublingual ducts
Sublingual caruncle with opening of submandibular duct (of Wharton)
Frenulum of lower lip
Tubercle of upper lip
Parotid papilla with opening of parotid duct (of Stensen)


Incisive papilla
Transverse palatine folds
Palatine raphe
Palatine process of maxilla
Palatine glands
Horizontal plate of palatine bone
Palatine aponeurosis (from tensor veli palatini muscle)
Uvular muscle
Molar minor salivary glands
Palatopharyngeus muscle
Palatine tonsil
Incisive fossa
Greater palatine artery and nerve
Greater palatine foramen
Lesser palatine foramen
Lesser palatine artery and nerves
Tendon of tensor veli palatini muscle
Pterygoid hamulus
Interdigitating fibers of levator veli palatini muscle
Buccinator muscle
Pterygomandibular raphe
Superior pharyngeal constrictor muscle
Palatoglossus muscle
Anterior view
Basilar part of occipital bone
Cartilaginous part of pharyngotympanic (auditory, eustachian) tube
Levator veli palatini muscle (cut)
Tensor veli palatini muscle
Medial pterygoid muscle (cut)
Medial pterygoid plate
Pterygoid hamulus
Tendon of tensor veli palatini muscle
Levator veli palatini muscle (cut)
Palatopharyngeus muscle (cut)
Uvular muscle
Pharyngobasilar fascia
Levator veli palatini muscle
Choanae
Pterygoid hamulus
Superior pharyngeal constrictor muscle (cut)
Palatopharyngeus muscle
Posterior view

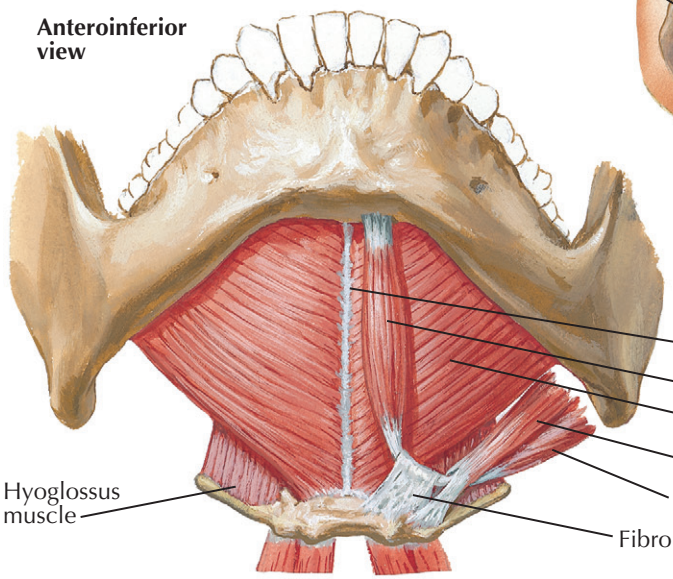
Floor of Oral Cavity

See also Plate 28

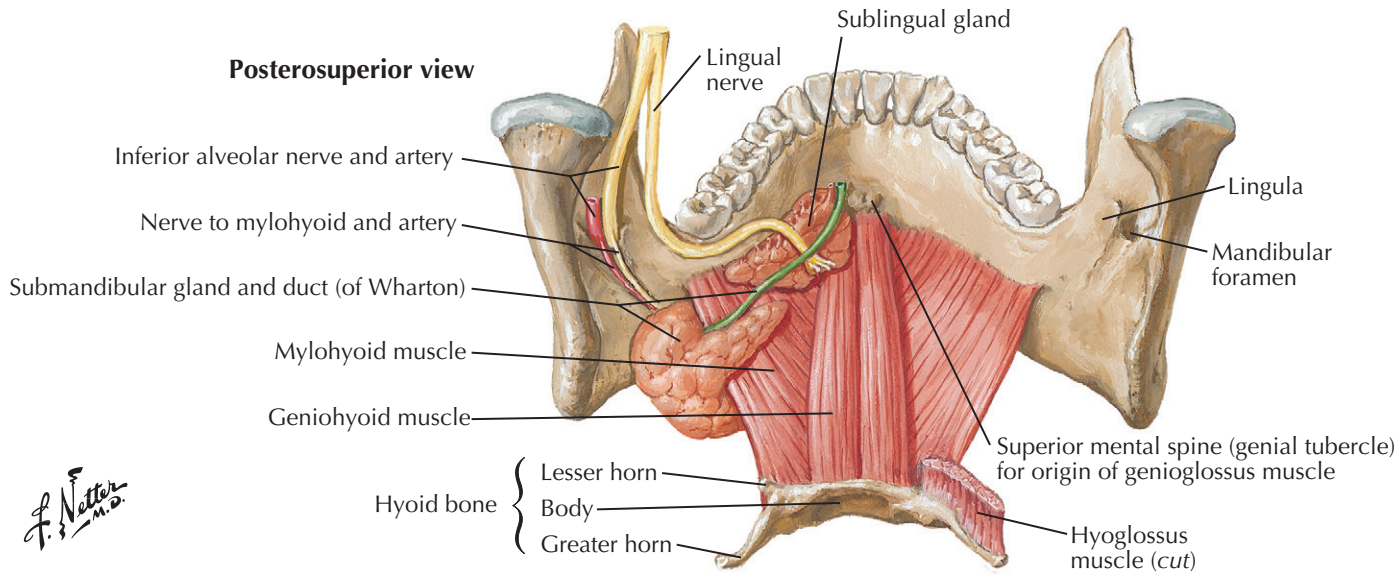
Lateral, slightly inferior view

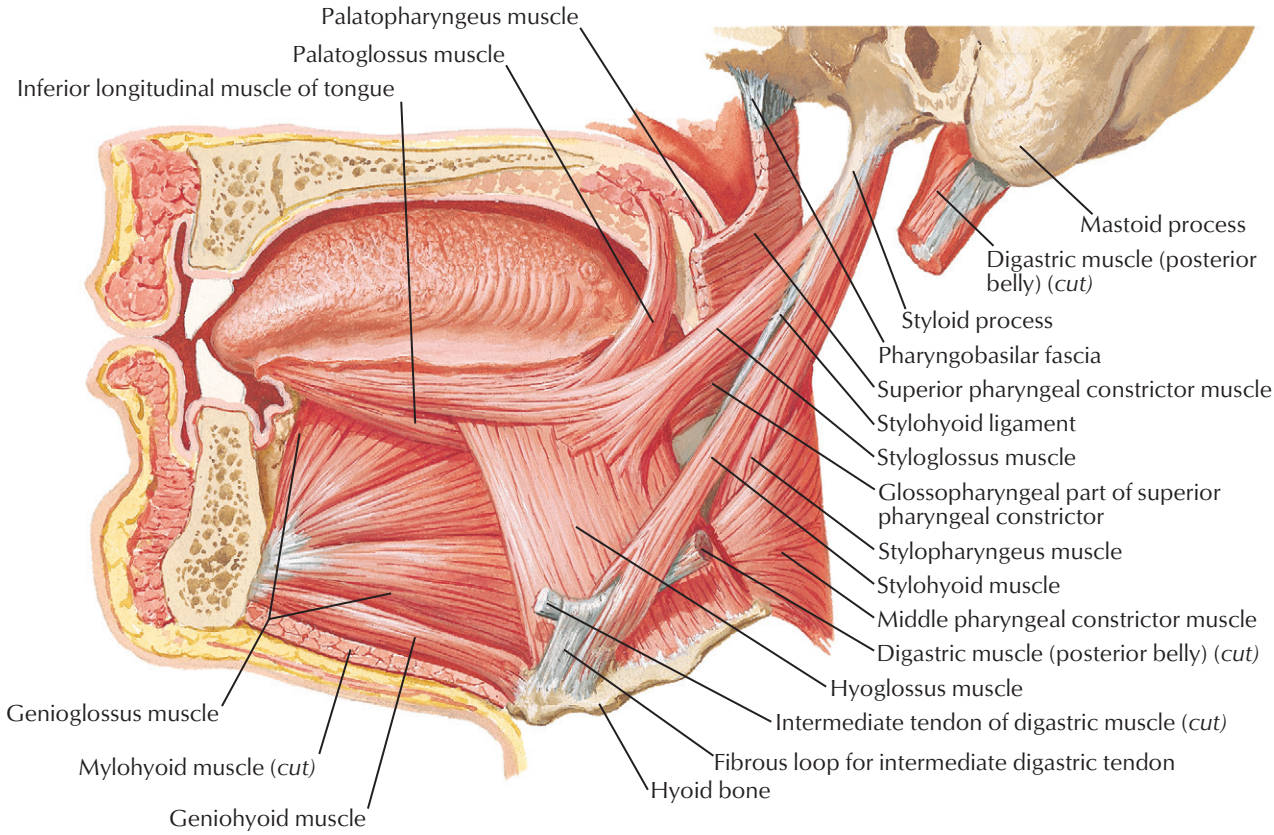


Anteroinferior view

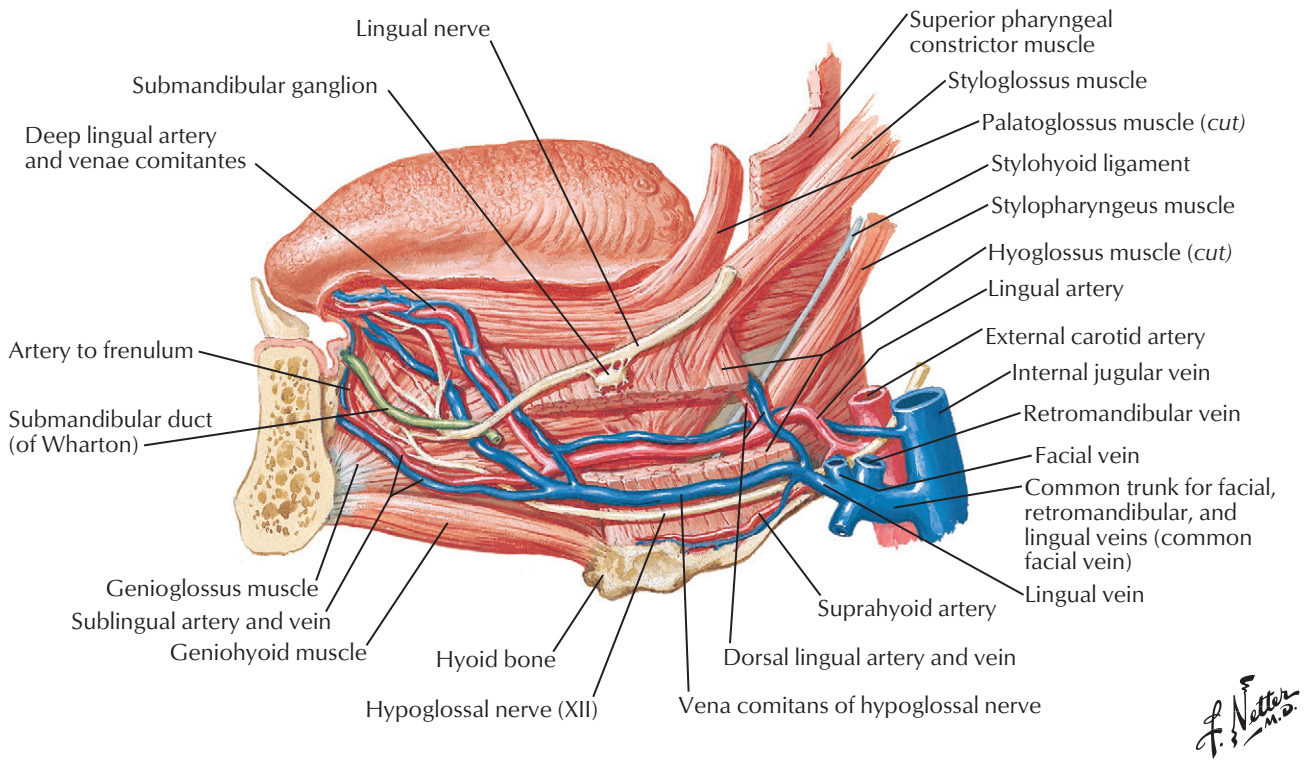


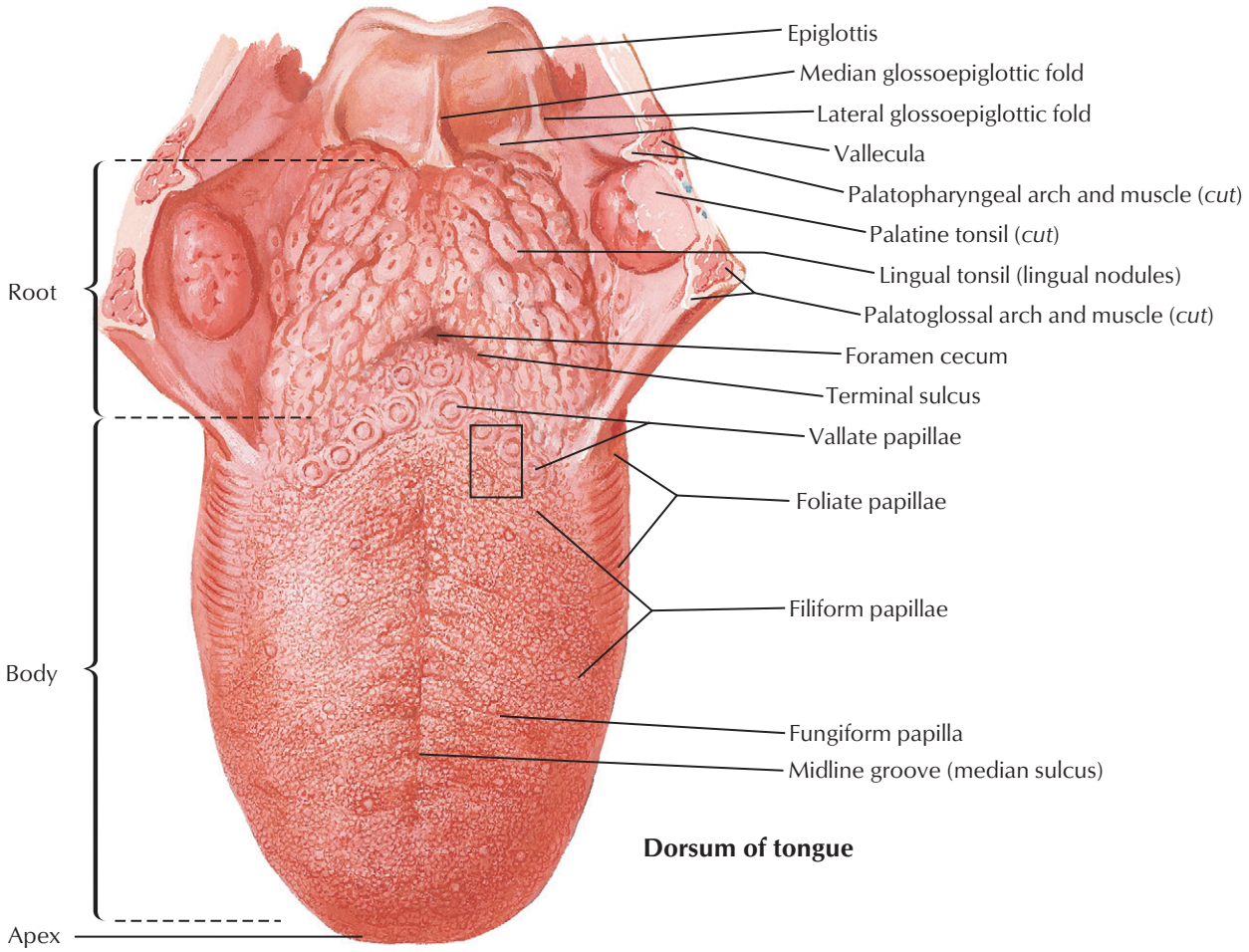
Posterosuperior view



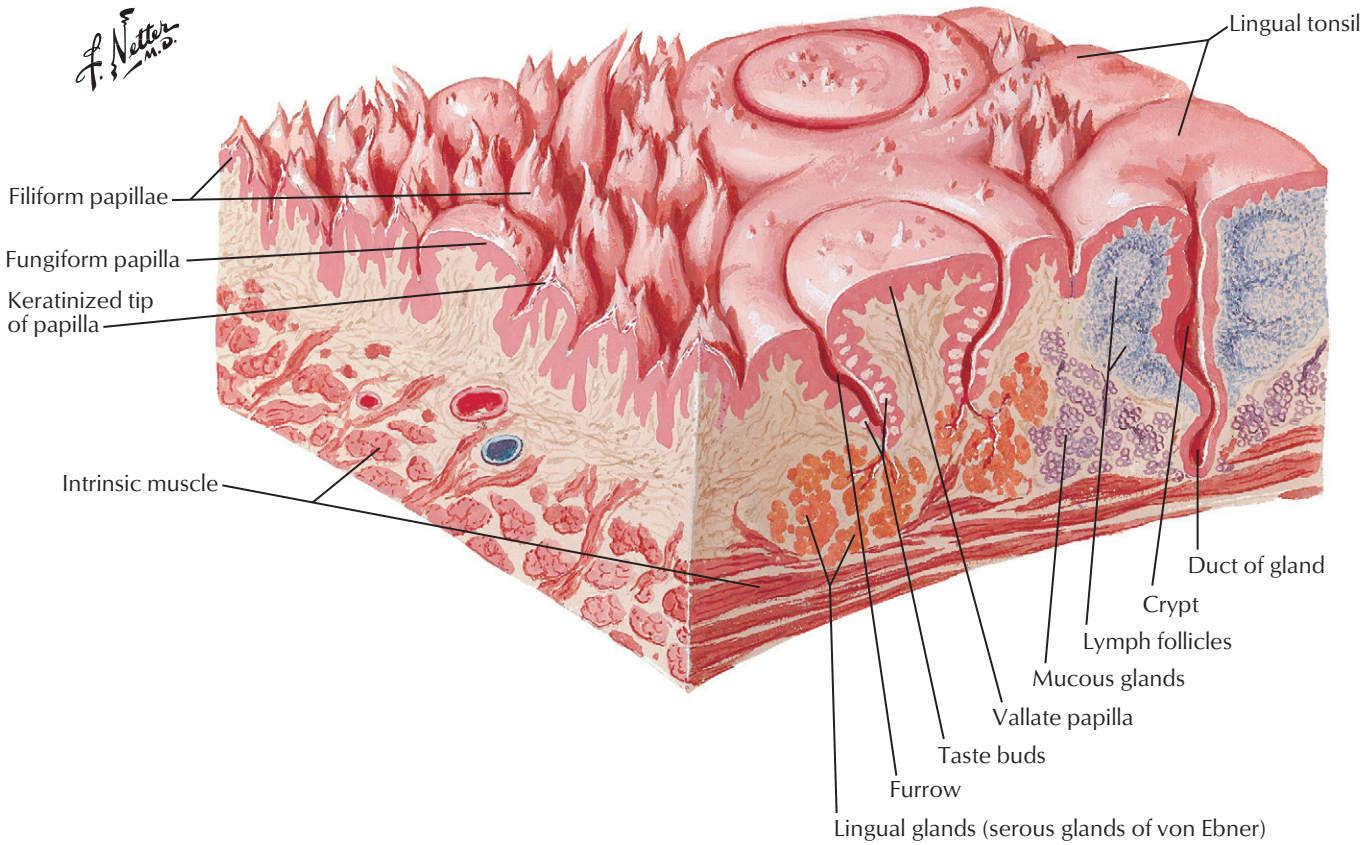


Lateral view





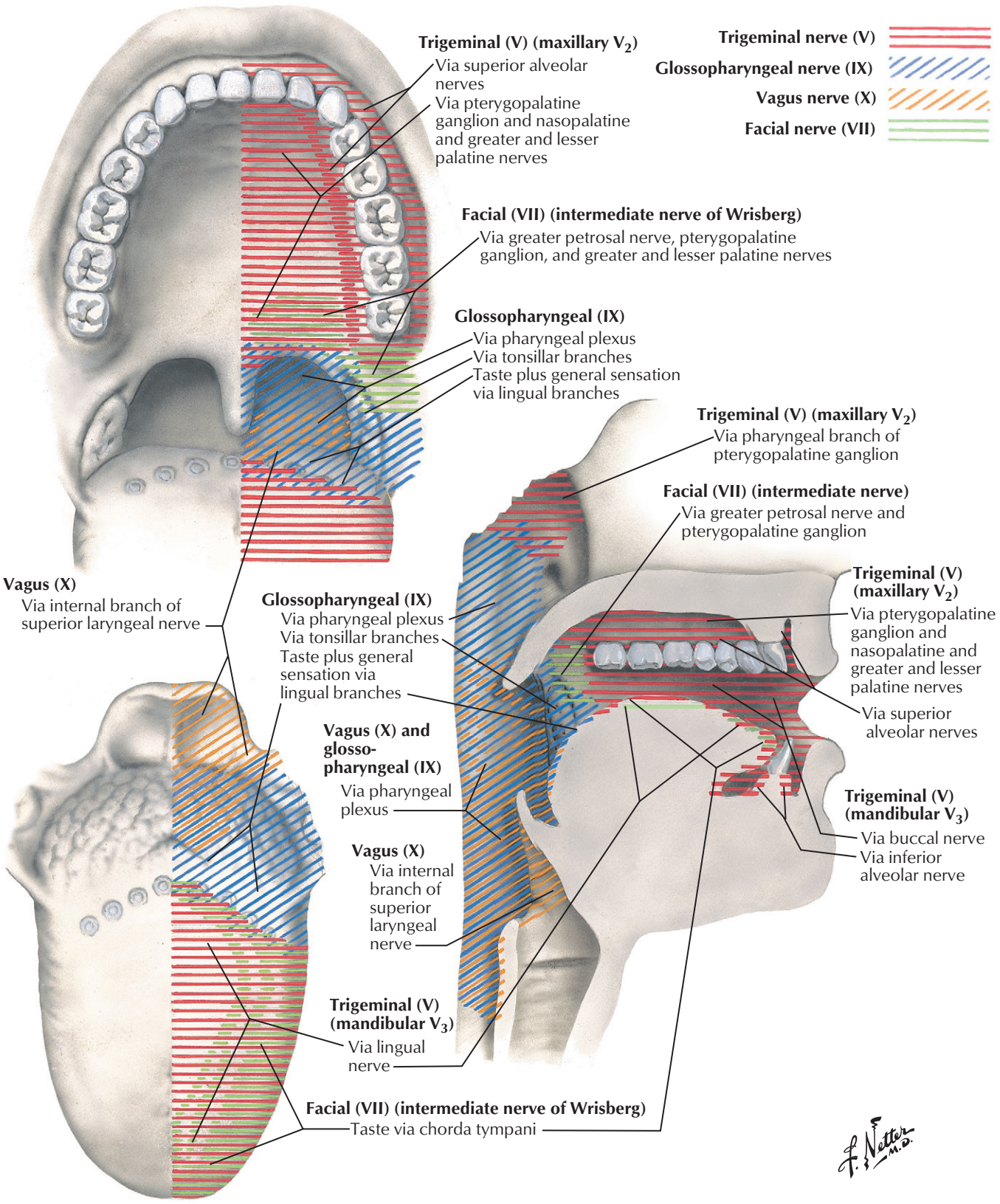
Dorsum of tongue

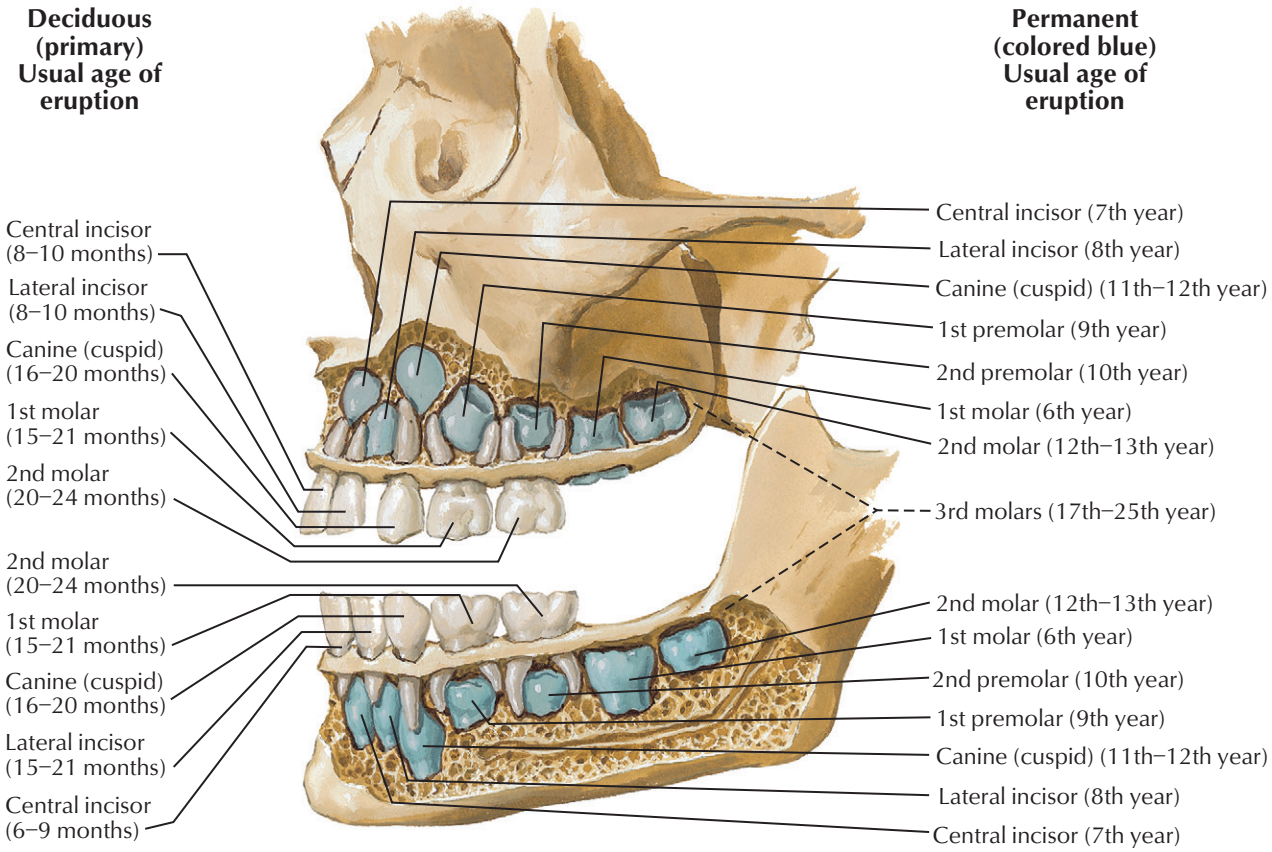


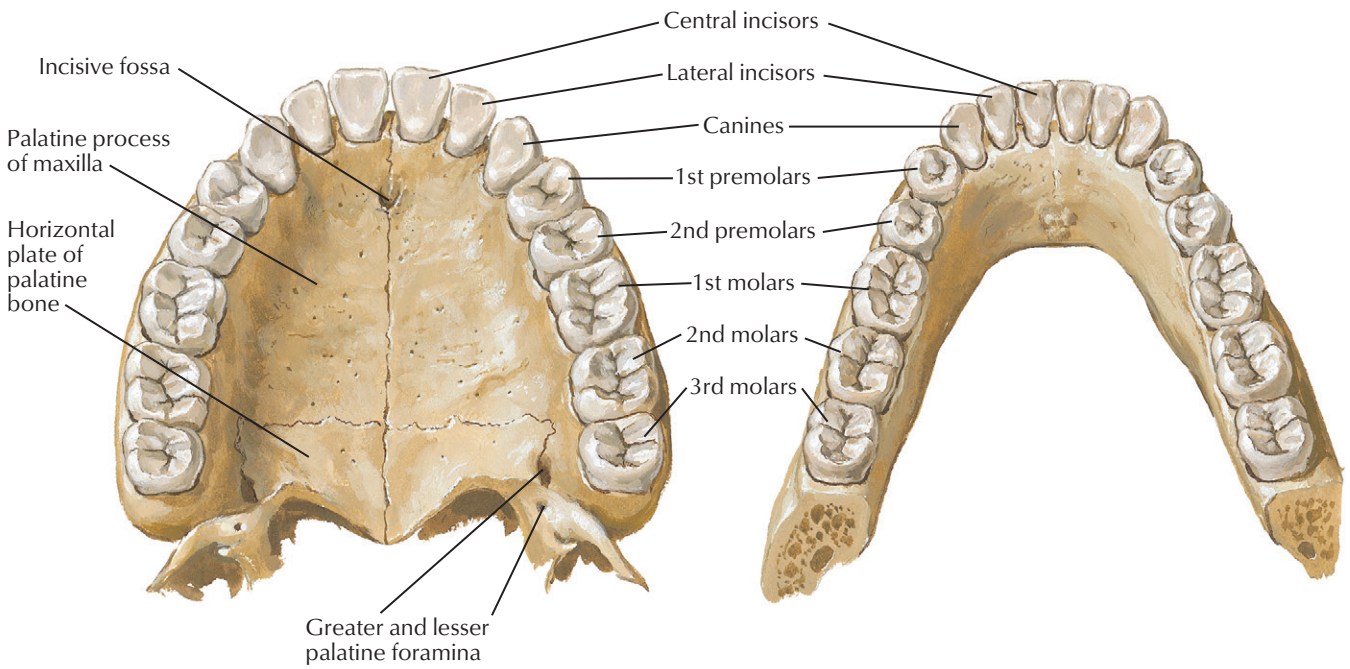
Schematic stereogram: area indicated above

Afferent Innervation of Oral Cavity and Pharynx

See also Plates 126, 134, 136

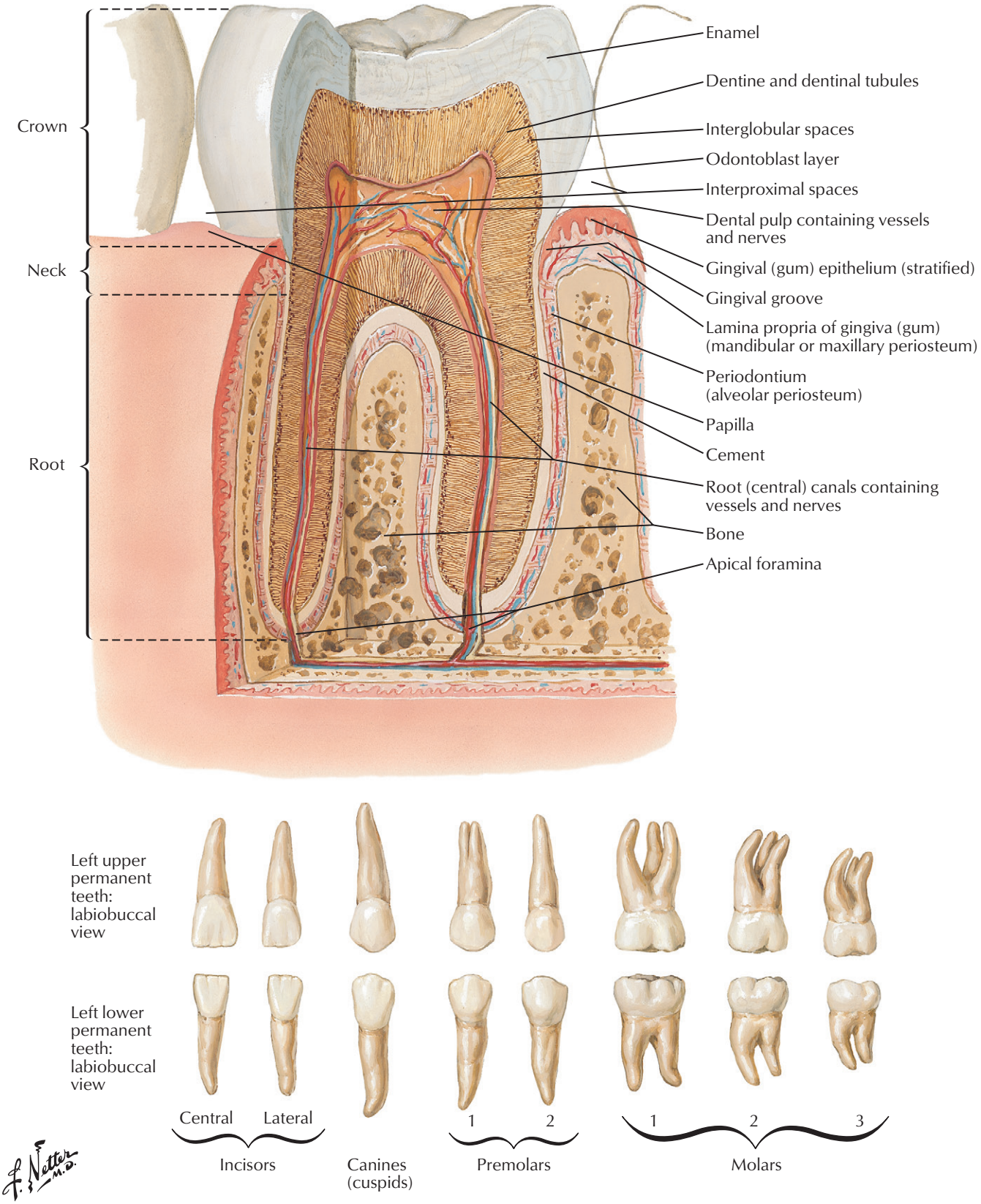


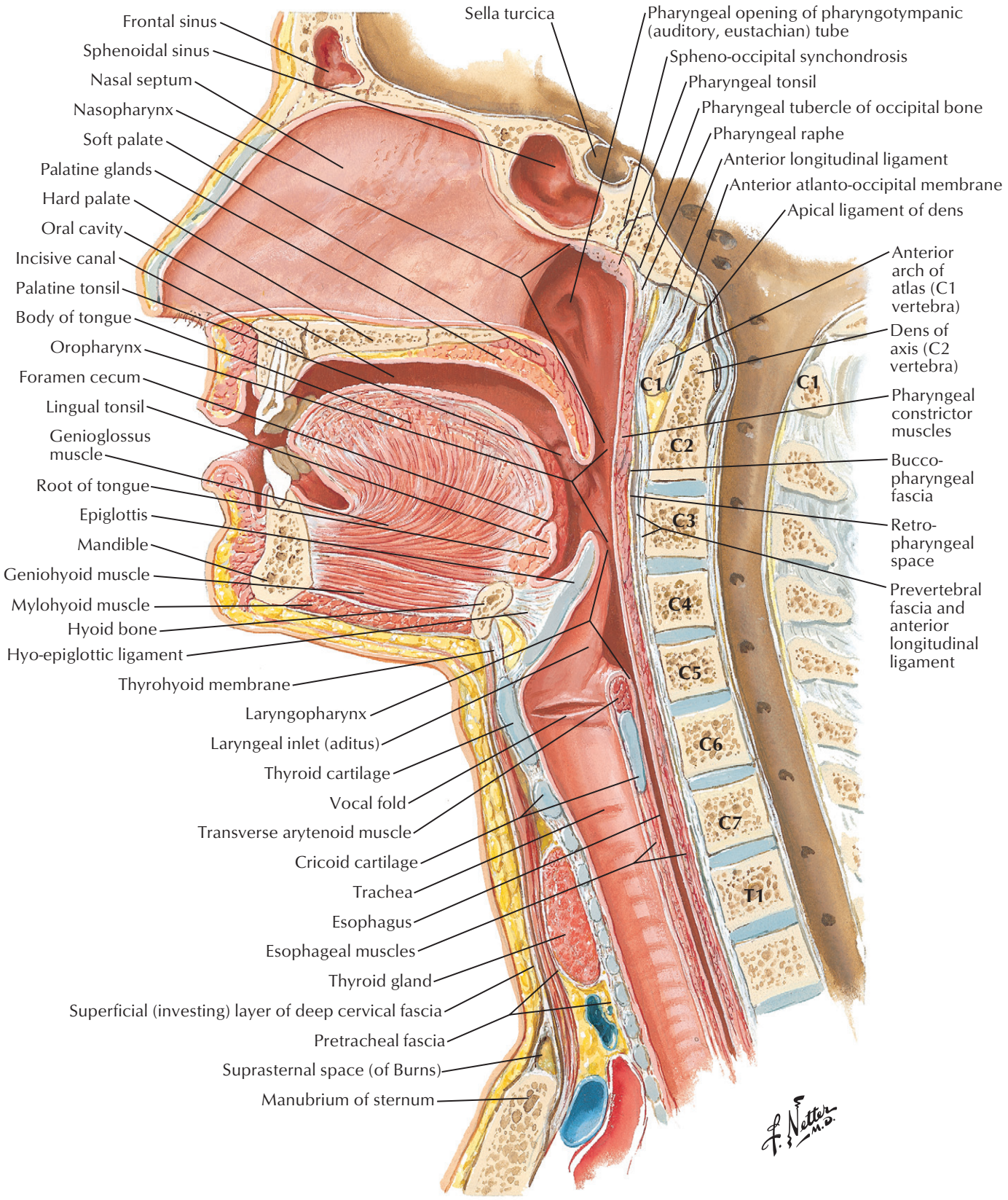


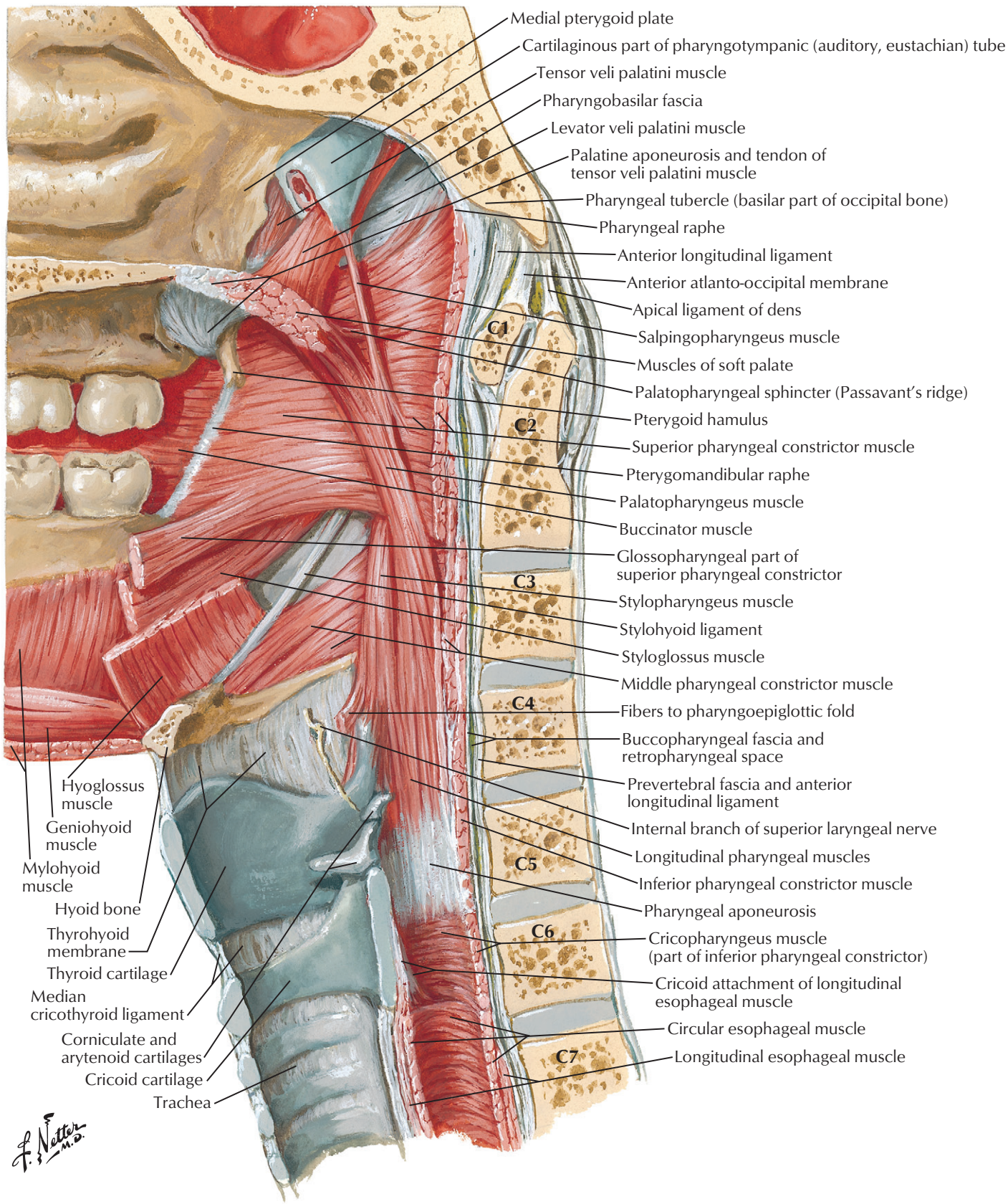


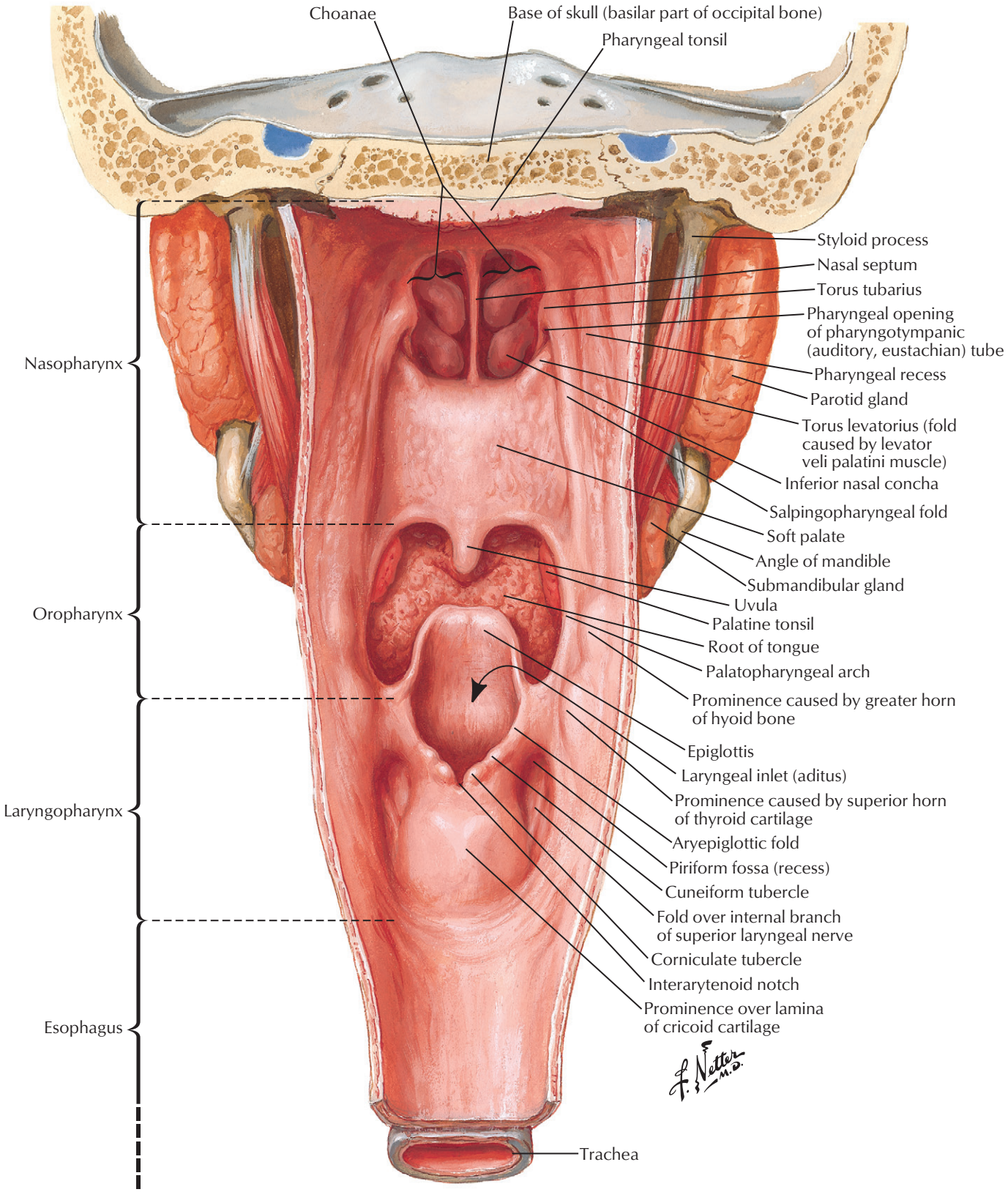
Upper permanent teeth

Lower permanent teeth


Crown
Neck
Root
Enamel
Dentine and dentinal tubules
Interglobular spaces
Odontoblast layer
Interproximal spaces
Dental pulp containing vessels and nerves
Gingival (gum) epithelium (stratified)
Gingival groove
Lamina propria of gingiva (gum) (mandibular or maxillary periosteum)
Periodontium (alveolar periosteum)
Papilla
Cement
Root (central) canals containing vessels and nerves
Bone
Apical foramina
Left upper permanent teeth: labiobuccal view
Left lower permanent teeth: labiobuccal view
Central
Lateral
Incisors
Canines (cuspids)
1
2
Premolars
1
2
3
Molars

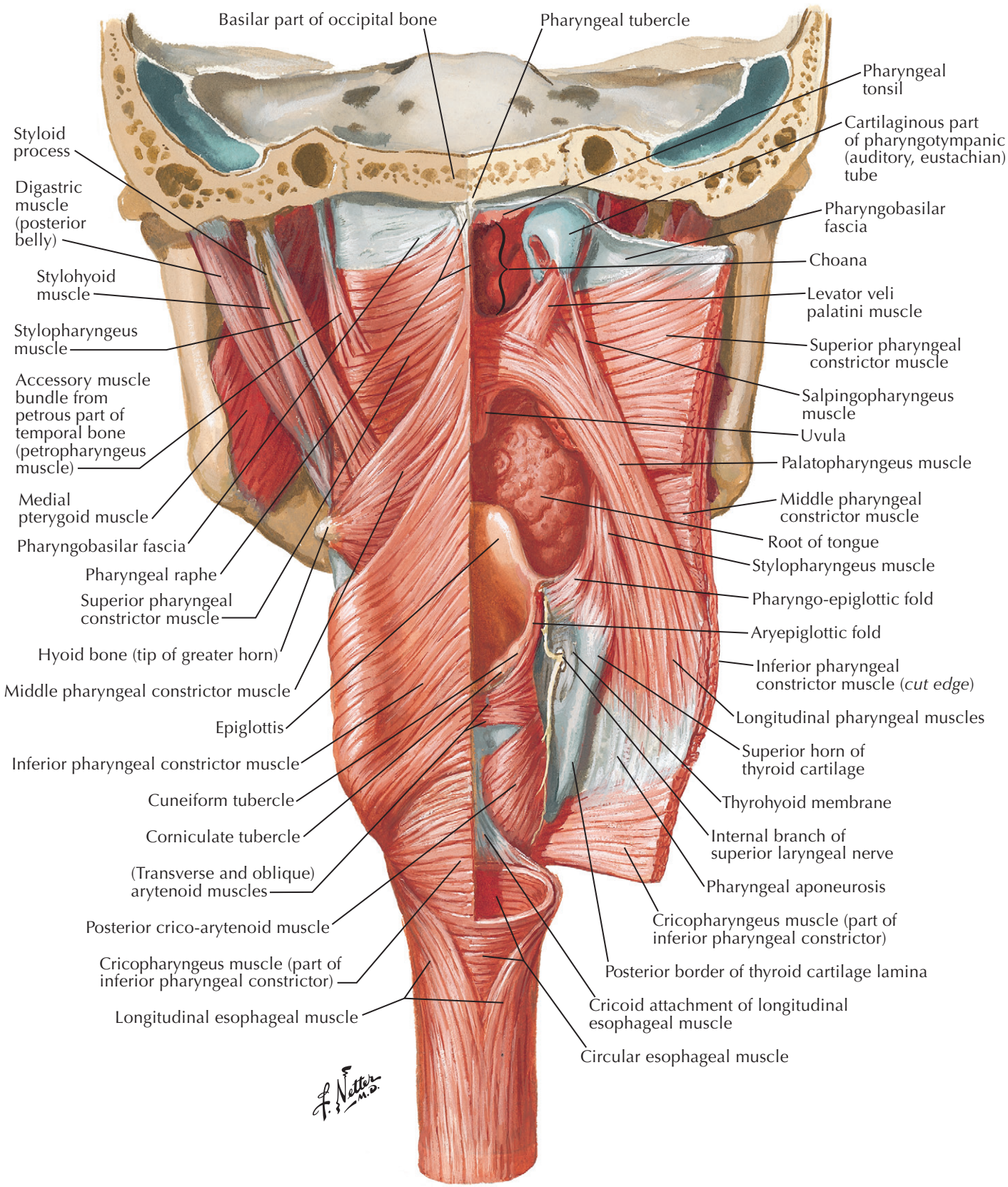

Frontal sinus
Sphenoidal sinus
Nasal septum
Nasopharynx
Soft palate
Palatine glands
Hard palate
Oral cavity
Incisive canal
Palatine tonsil
Body of tongue
Oropharynx
Foramen cecum
Lingual tonsil
Genioglossus muscle
Root of tongue
Epiglottis
Mandible
Geniohyoid muscle
Mylohyoid muscle
Hyoid bone
Hyo-epiglottic ligament
Thyrohyoid membrane
Laryngopharynx
Laryngeal inlet (aditus)
Thyroid cartilage
Vocal fold
Transverse arytenoid muscle
Cricoid cartilage
Trachea
Esophagus
Esophageal muscles
Thyroid gland
Superficial (investing) layer of deep cervical fascia
Pretracheal fascia
Suprasternal space (of Burns)
Manubrium of sternum
Sella turcica
Pharyngeal opening of pharyngotympanic (auditory, eustachian) tube
Spheno-occipital synchondrosis
Pharyngeal tonsil
Pharyngeal tubercle of occipital bone
Pharyngeal raphe
Anterior longitudinal ligament
Anterior atlanto-occipital membrane
Apical ligament of dens
Anterior arch of atlas (C1 vertebra)
Dens of axis (C2 vertebra)
Pharyngeal constrictor muscles
Bucco-pharyngeal fascia
Retro-pharyngeal space
Prevertebral fascia and anterior longitudinal ligament
C1
C1
C2
C3
C4
C5
C6
C7
T1


Medial pterygoid plate
Cartilaginous part of pharyngotympanic (auditory, eustachian) tube
Tensor veli palatini muscle
Pharyngobasilar fascia
Levator veli palatini muscle
Palatine aponeurosis and tendon of tensor veli palatini muscle
Pharyngeal tubercle (basilar part of occipital bone)
Pharyngeal raphe
Anterior longitudinal ligament
Anterior atlanto-occipital membrane
Apical ligament of dens
C1
Salpingopharyngeus muscle
Muscles of soft palate
Palatopharyngeal sphincter (Passavant's ridge)
Pterygoid hamulus
C2
Superior pharyngeal constrictor muscle
Pterygomandibular raphe
Palatopharyngeus muscle
Buccinator muscle
Glossopharyngeal part of superior pharyngeal constrictor
C3
Stylopharyngeus muscle
Stylohyoid ligament
Styloglossus muscle
Middle pharyngeal constrictor muscle
C4
Fibers to pharyngoepiglottic fold
Buccopharyngeal fascia and retropharyngeal space
Prevertebral fascia and anterior longitudinal ligament
Internal branch of superior laryngeal nerve
Longitudinal pharyngeal muscles
C5
Inferior pharyngeal constrictor muscle
Pharyngeal aponeurosis
C6
Cricopharyngeus muscle (part of inferior pharyngeal constrictor)
Cricoid attachment of longitudinal esophageal muscle
Circular esophageal muscle
C7
Longitudinal esophageal muscle
Hyoglossus muscle
Geniohyoid muscle
Mylohyoid muscle
Hyoid bone
Thyrohyoid membrane
Thyroid cartilage
Median cricothyroid ligament
Corniculate and arytenoid cartilages
Cricoid cartilage
Trachea
F. Netter M.D.

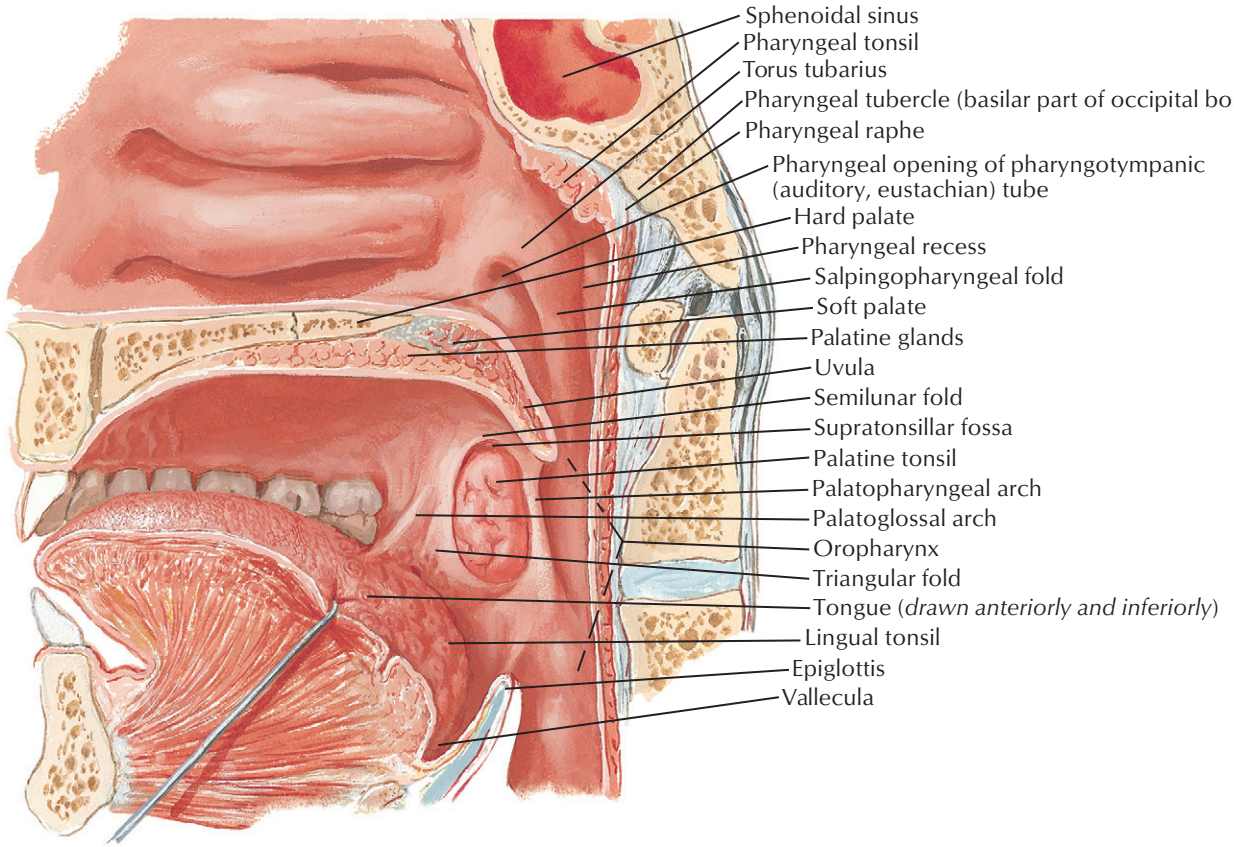

Choanae
Base of skull (basilar part of occipital bone)
Pharyngeal tonsil
Styloid process
Nasal septum
Torus tubarius
Pharyngeal opening of pharyngotympanic (auditory, eustachian) tube
Pharyngeal recess
Parotid gland
Torus levatorius (fold caused by levator veli palatini muscle)
Inferior nasal concha
Salpingopharyngeal fold
Soft palate
Angle of mandible
Submandibular gland
Uvula
Palatine tonsil
Root of tongue
Palatopharyngeal arch
Prominence caused by greater horn of hyoid bone
Epiglottis
Laryngeal inlet (aditus)
Prominence caused by superior horn of thyroid cartilage
Aryepiglottic fold
Piriform fossa (recess)
Cuneiform tubercle
Fold over internal branch of superior laryngeal nerve
Corniculate tubercle
Interarytenoid notch
Prominence over lamina of cricoid cartilage
Trachea
Nasopharynx
Oropharynx
Laryngopharynx
Esophagus

Muscles of Pharynx: Partially Opened Posterior View

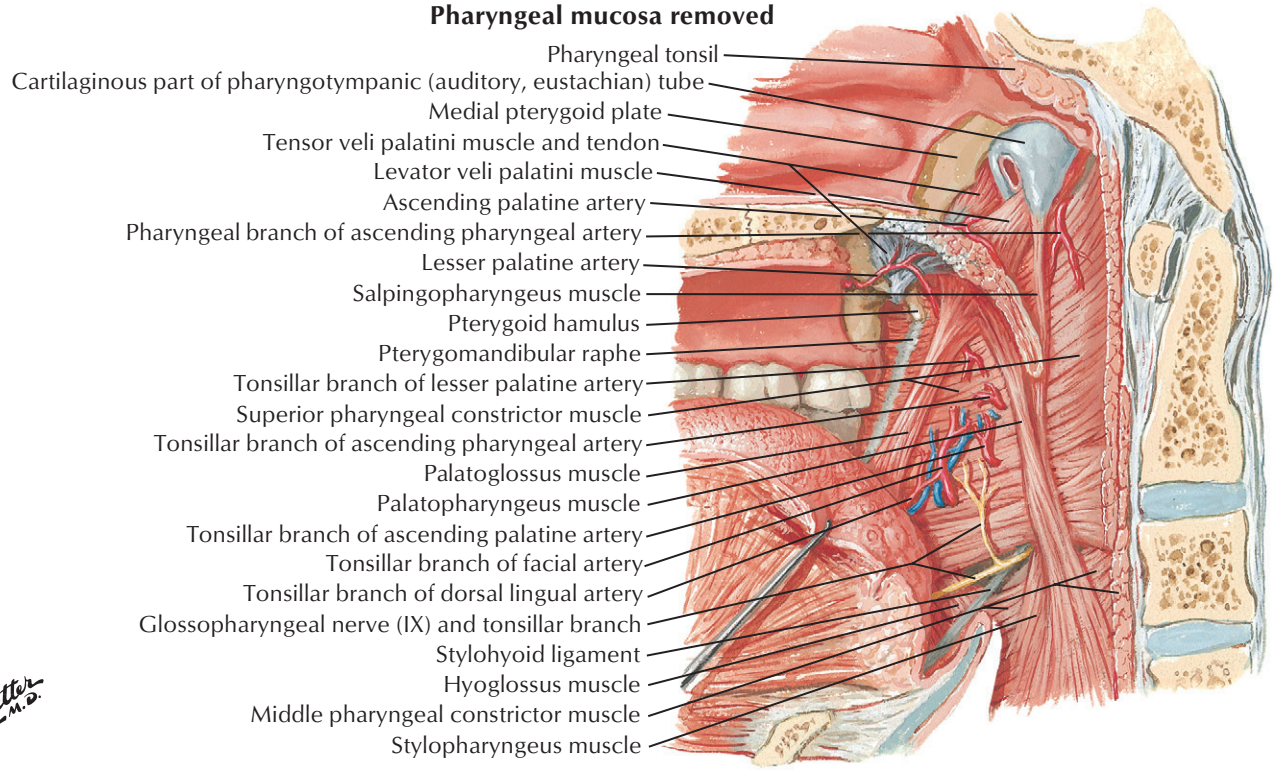
See also Plate 70

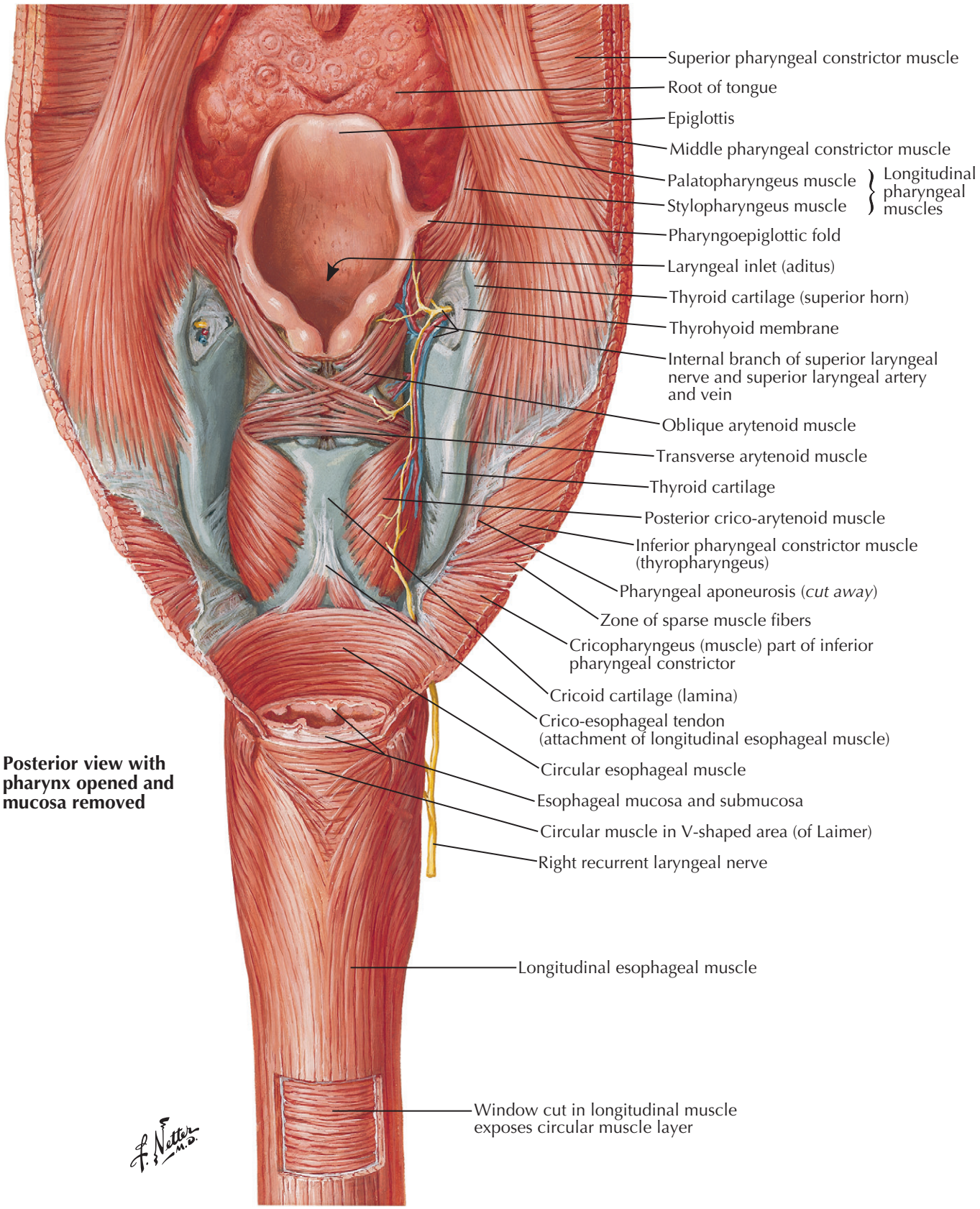


Medial view
sagittal section



Pharyngeal mucosa removed

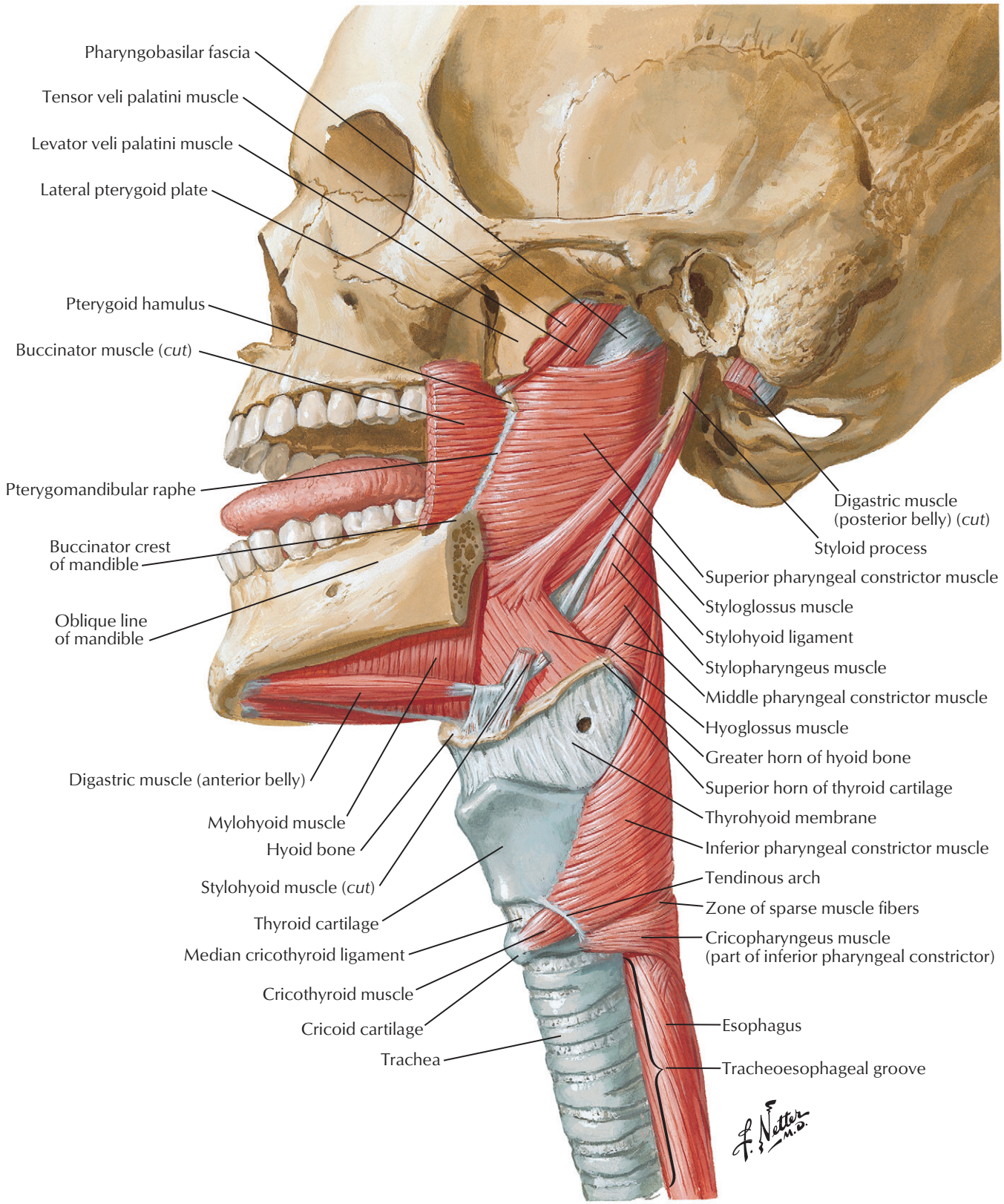


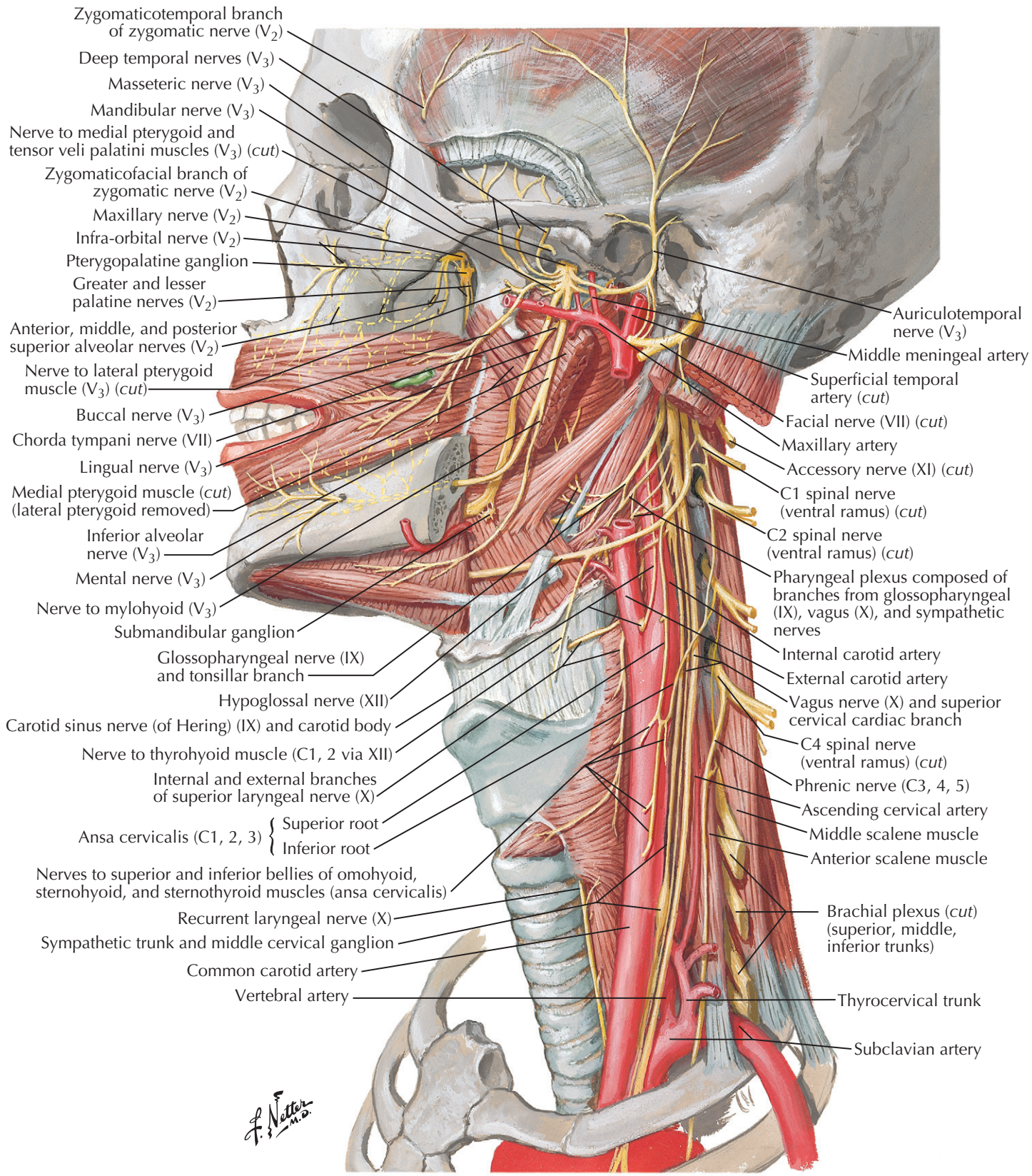


Posterior view with pharynx opened and mucosa removed

Muscles of Pharynx: Lateral View

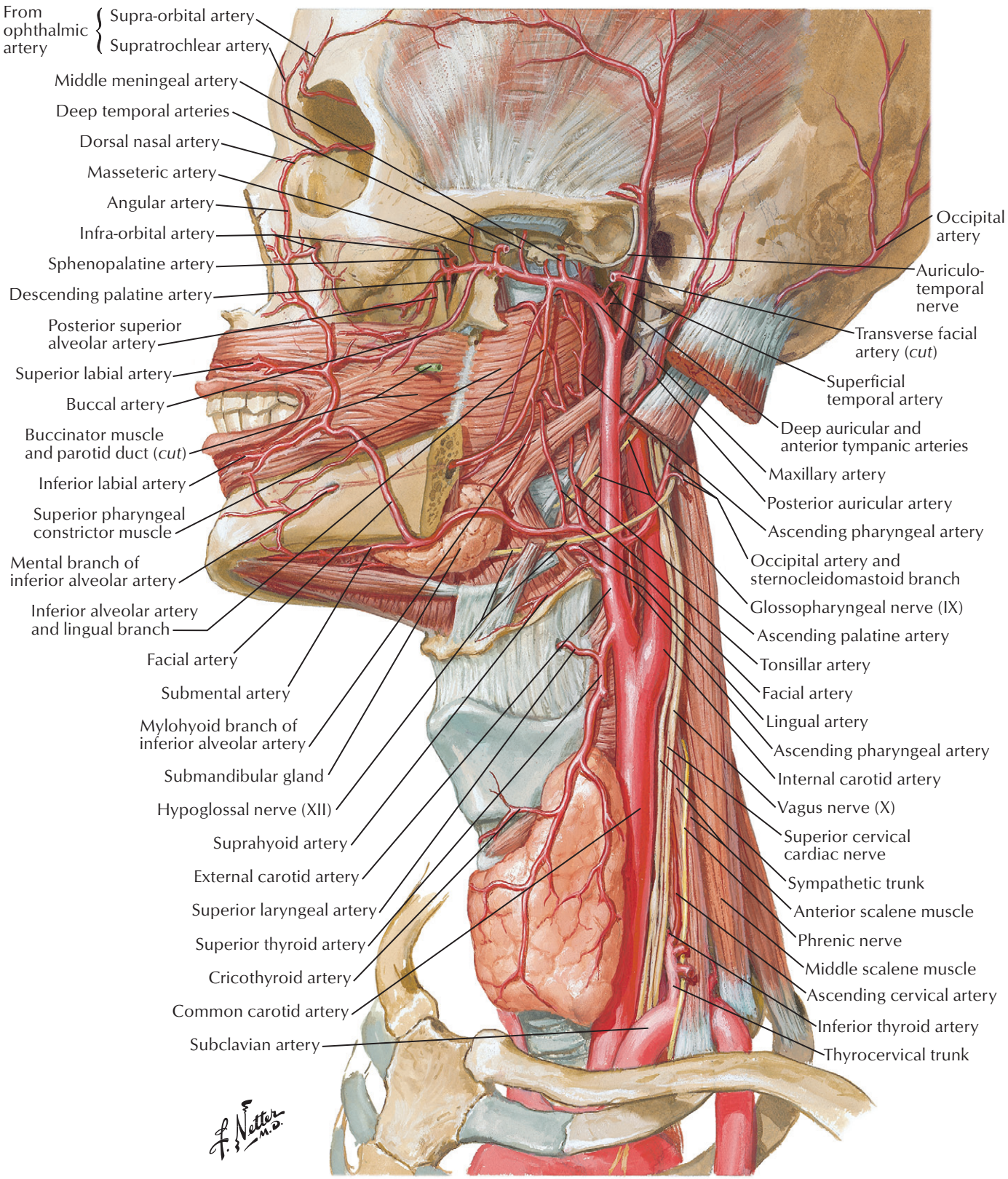
See also Plate 67

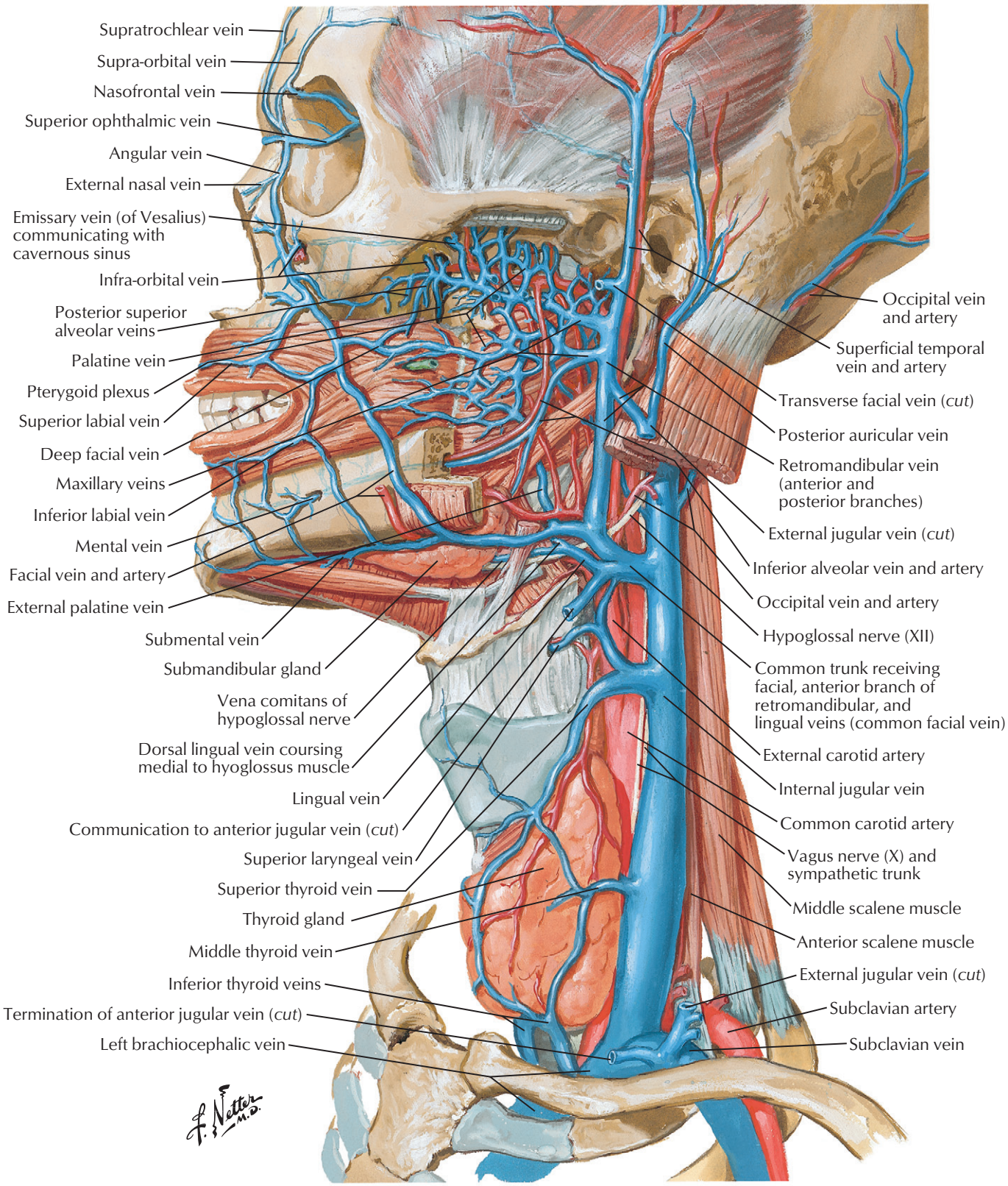



Zygomaticotemporal branch of zygomatic nerve (V_2)
Deep temporal nerves (V_3)
Masseteric nerve (V_3)
Mandibular nerve (V_3)
Nerve to medial pterygoid and tensor veli palatini muscles (V_3) (*cut*)
Zygomaticofacial branch of zygomatic nerve (V_2)
Maxillary nerve (V_2)
Infra-orbital nerve (V_2)
Pterygopalatine ganglion
Greater and lesser palatine nerves (V_2)
Anterior, middle, and posterior superior alveolar nerves (V_2)
Nerve to lateral pterygoid muscle (V_3) (*cut*)
Buccal nerve (V_3)
Chorda tympani nerve (VII)
Lingual nerve (V_3)
Medial pterygoid muscle (*cut*) (lateral pterygoid removed)
Inferior alveolar nerve (V_3)
Mental nerve (V_3)
Nerve to mylohyoid (V_3)
Submandibular ganglion
Glossopharyngeal nerve (IX) and tonsillar branch
Hypoglossal nerve (XII)
Carotid sinus nerve (of Hering) (IX) and carotid body
Nerve to thyrohyoid muscle (C1, 2 via XII)
Internal and external branches of superior laryngeal nerve (X)
Ansa cervicalis (C1, 2, 3)
Superior root
Inferior root
Nerves to superior and inferior bellies of omohyoid, sternohyoid, and sternothyroid muscles (ansa cervicalis)
Recurrent laryngeal nerve (X)
Sympathetic trunk and middle cervical ganglion
Common carotid artery
Vertebral artery
Auriculotemporal nerve (V_3)
Middle meningeal artery
Superficial temporal artery (*cut*)
Facial nerve (VII) (*cut*)
Maxillary artery
Accessory nerve (XI) (*cut*)
C1 spinal nerve (ventral ramus) (*cut*)
C2 spinal nerve (ventral ramus) (*cut*)
Pharyngeal plexus composed of branches from glossopharyngeal (IX), vagus (X), and sympathetic nerves
Internal carotid artery
External carotid artery
Vagus nerve (X) and superior cervical cardiac branch
C4 spinal nerve (ventral ramus) (*cut*)
Phrenic nerve (C3, 4, 5)
Ascending cervical artery
Middle scalene muscle
Anterior scalene muscle
Brachial plexus (*cut*) (superior, middle, inferior trunks)
Thyrocervical trunk
Subclavian artery
F. Netter M.D.

Arteries of Oral and Pharyngeal Regions

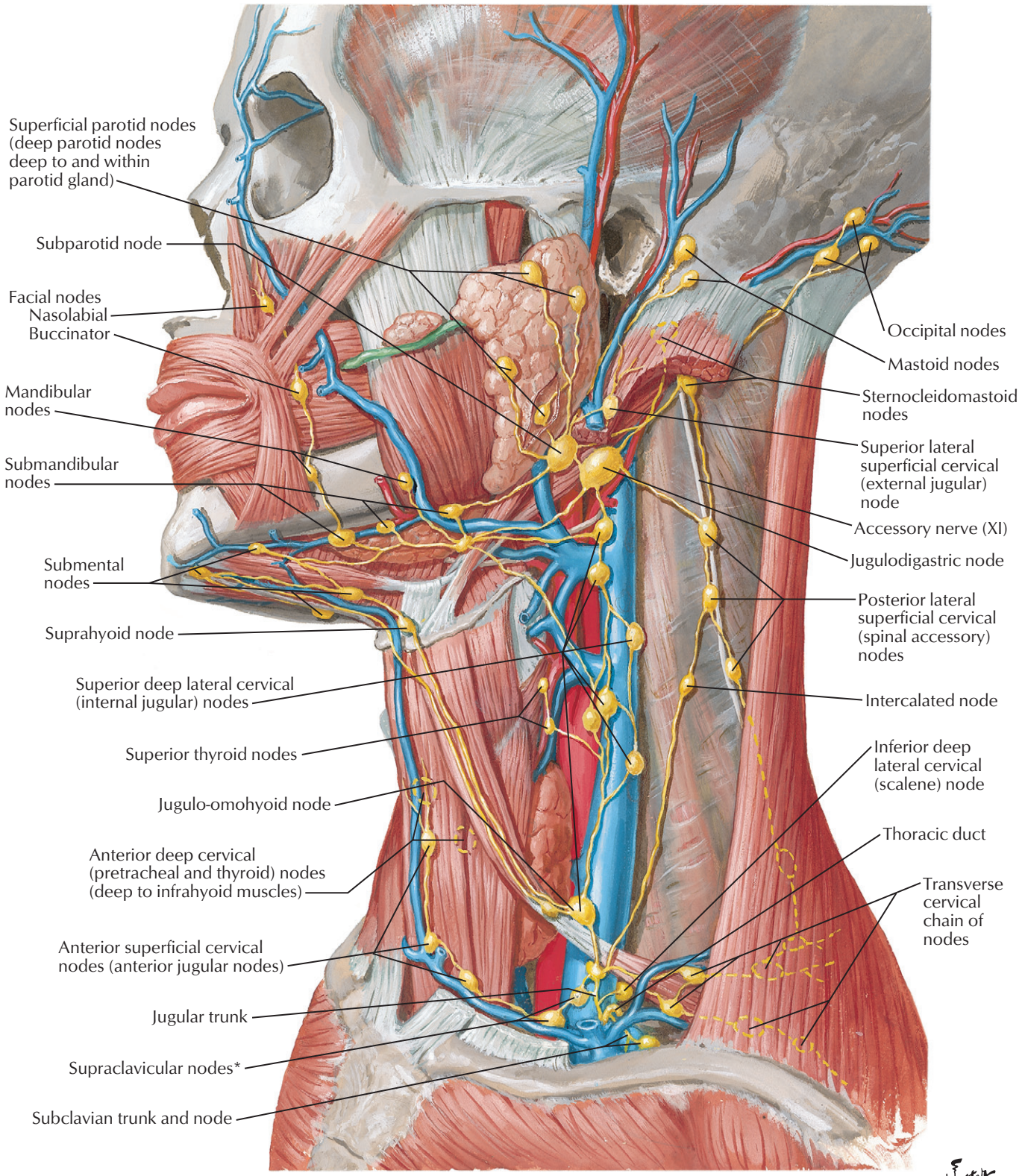
See also Plates 34, 51



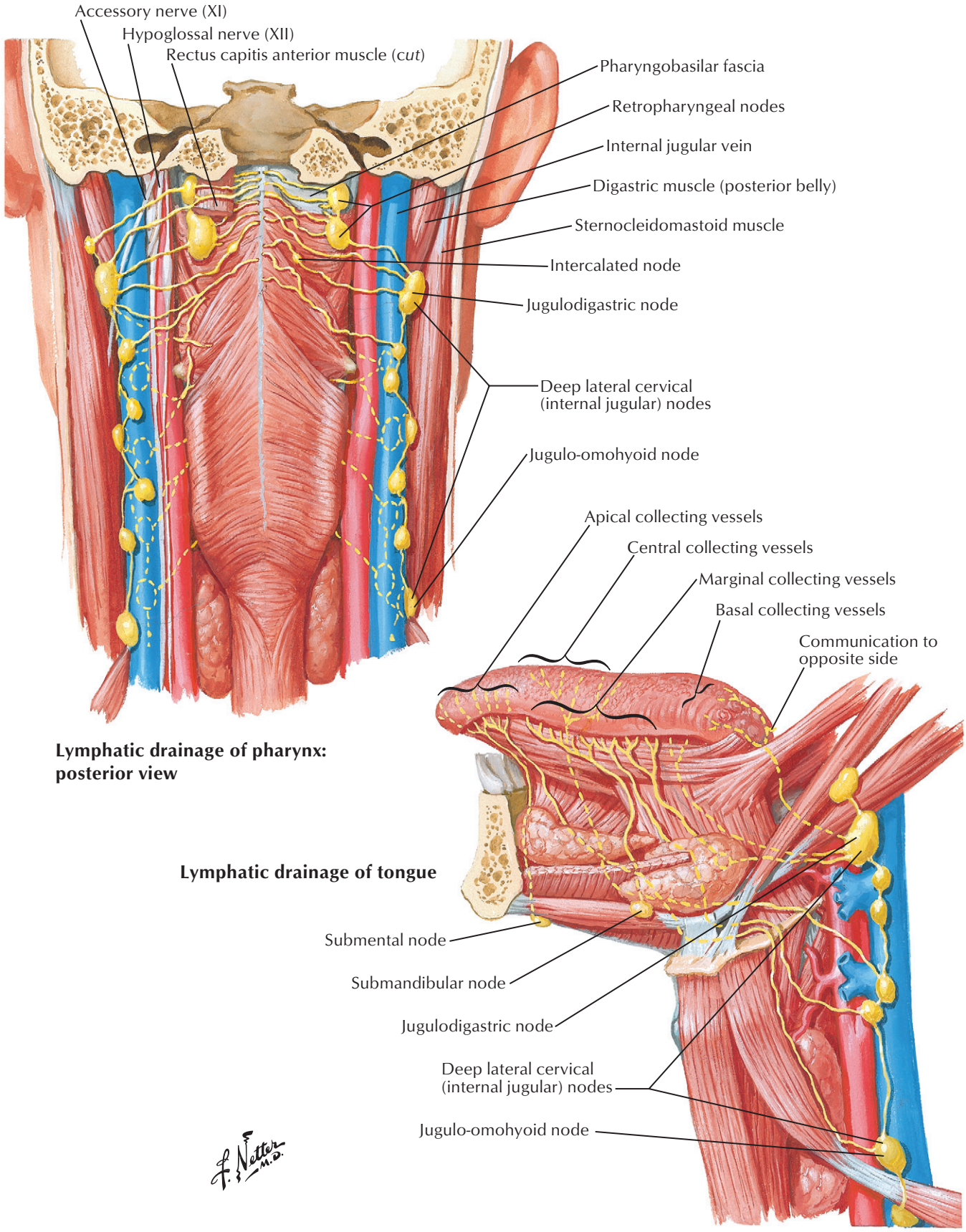

Supratrochlear vein
Supra-orbital vein
Nasofrontal vein
Superior ophthalmic vein
Angular vein
External nasal vein
Emissary vein (of Vesalius) communicating with cavernous sinus
Infra-orbital vein
Posterior superior alveolar veins
Palatine vein
Pterygoid plexus
Superior labial vein
Deep facial vein
Maxillary veins
Inferior labial vein
Mental vein
Facial vein and artery
External palatine vein
Submental vein
Submandibular gland
Vena comitans of hypoglossal nerve
Dorsal lingual vein coursing medial to hyoglossus muscle
Lingual vein
Communication to anterior jugular vein (cut)
Superior laryngeal vein
Superior thyroid vein
Thyroid gland
Middle thyroid vein
Inferior thyroid veins
Termination of anterior jugular vein (cut)
Left brachiocephalic vein
Occipital vein and artery
Superficial temporal vein and artery
Transverse facial vein (cut)
Posterior auricular vein
Retromandibular vein (anterior and posterior branches)
External jugular vein (cut)
Inferior alveolar vein and artery
Occipital vein and artery
Hypoglossal nerve (XII)
Common trunk receiving facial, anterior branch of retromandibular, and lingual veins (common facial vein)
External carotid artery
Internal jugular vein
Common carotid artery
Vagus nerve (X) and sympathetic trunk
Middle scalene muscle
Anterior scalene muscle
External jugular vein (cut)
Subclavian artery
Subclavian vein
F. Netter M.D.

Lymph Vessels and Nodes of Head and Neck

See also Plates 73, 105



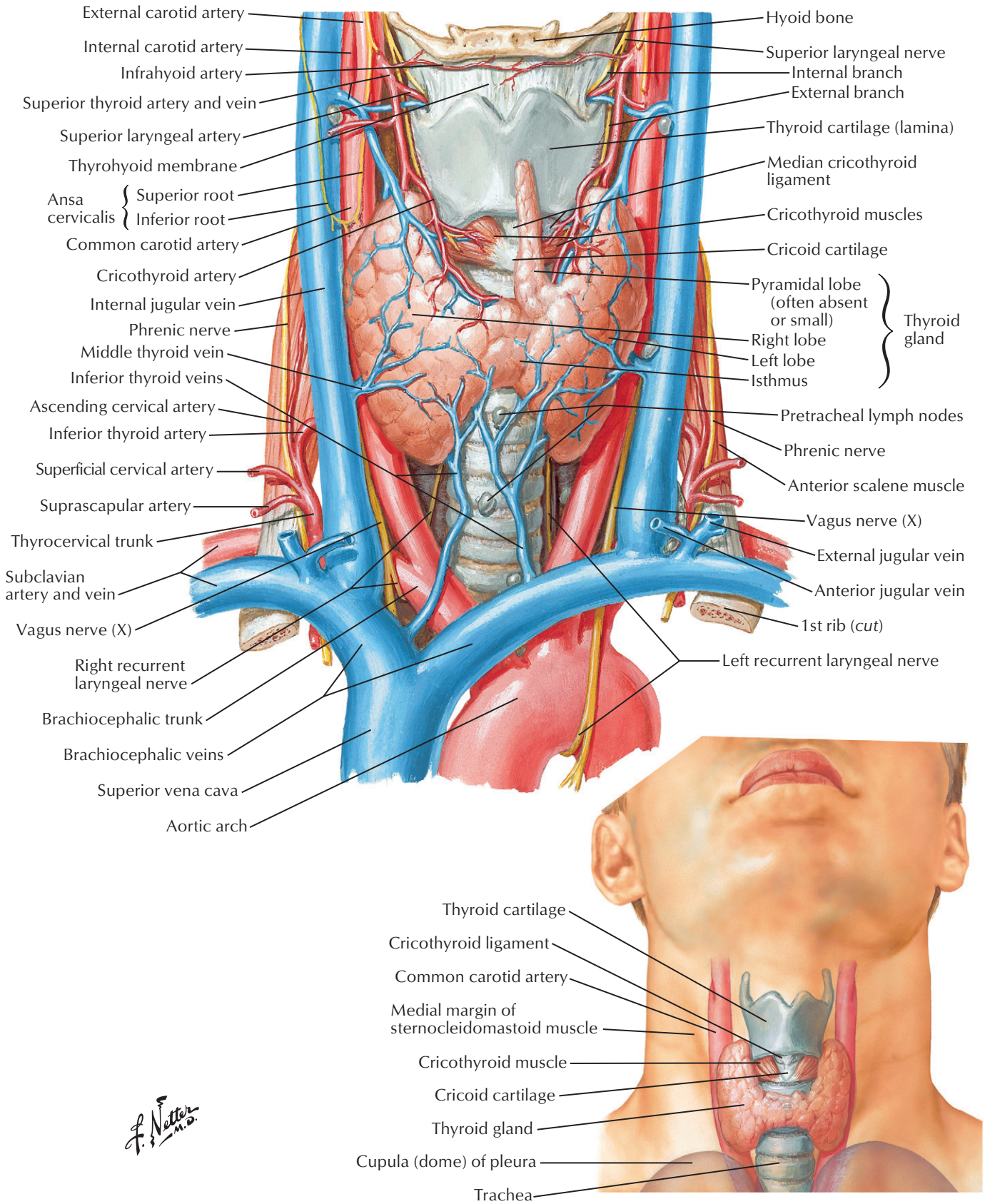
**The supraclavicular group of nodes (also known as the lower deep cervical group), especially on the left, are also sometimes referred to as the signal or sentinel lymph nodes of Virchow or Troisier, especially when sufficiently enlarged and palpable. These nodes (or a single node) are so termed because they may be the first recognized presumptive evidence of malignant disease in the viscera.*



Lymphatic drainage of pharynx: posterior view

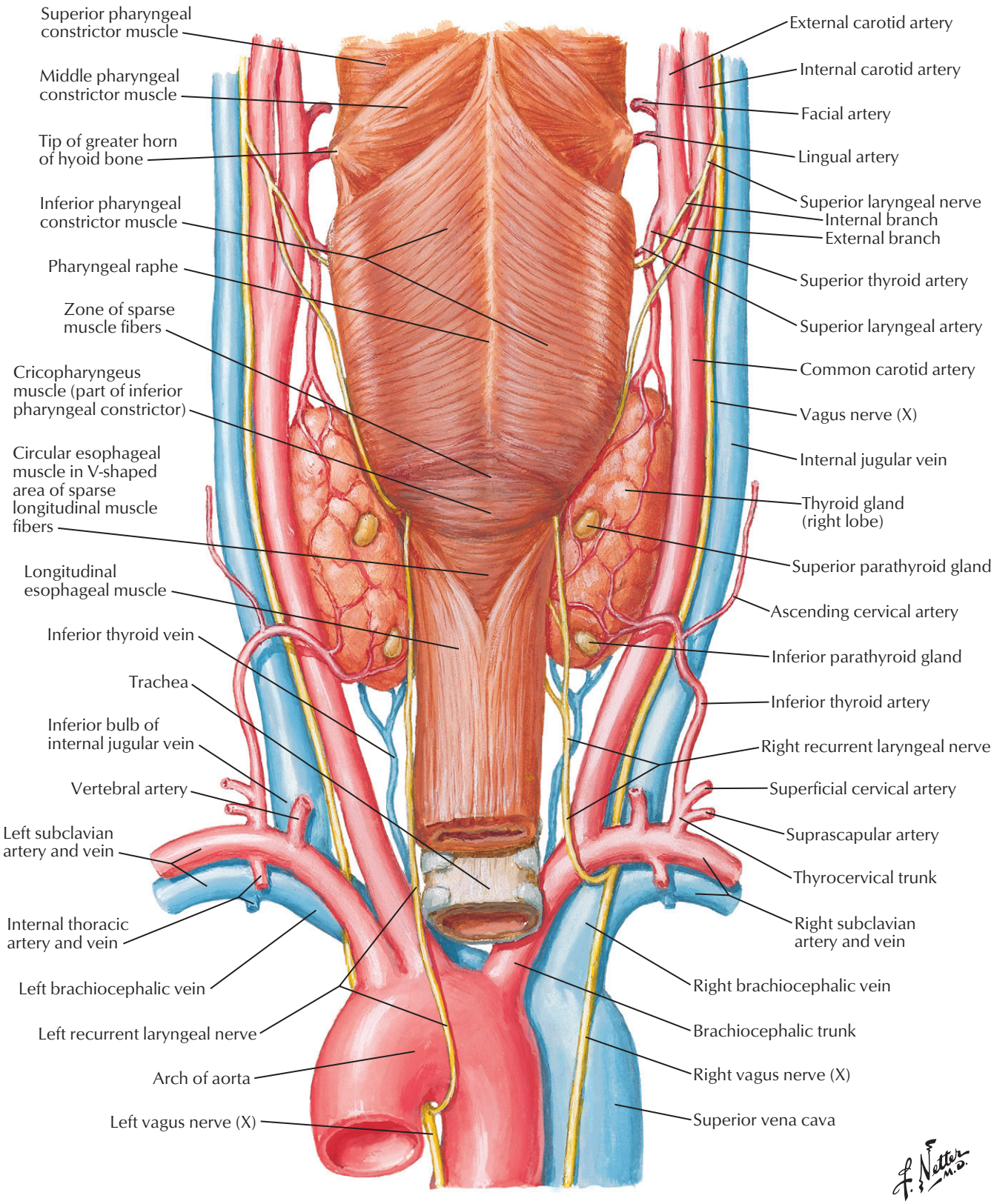
Lymphatic drainage of tongue

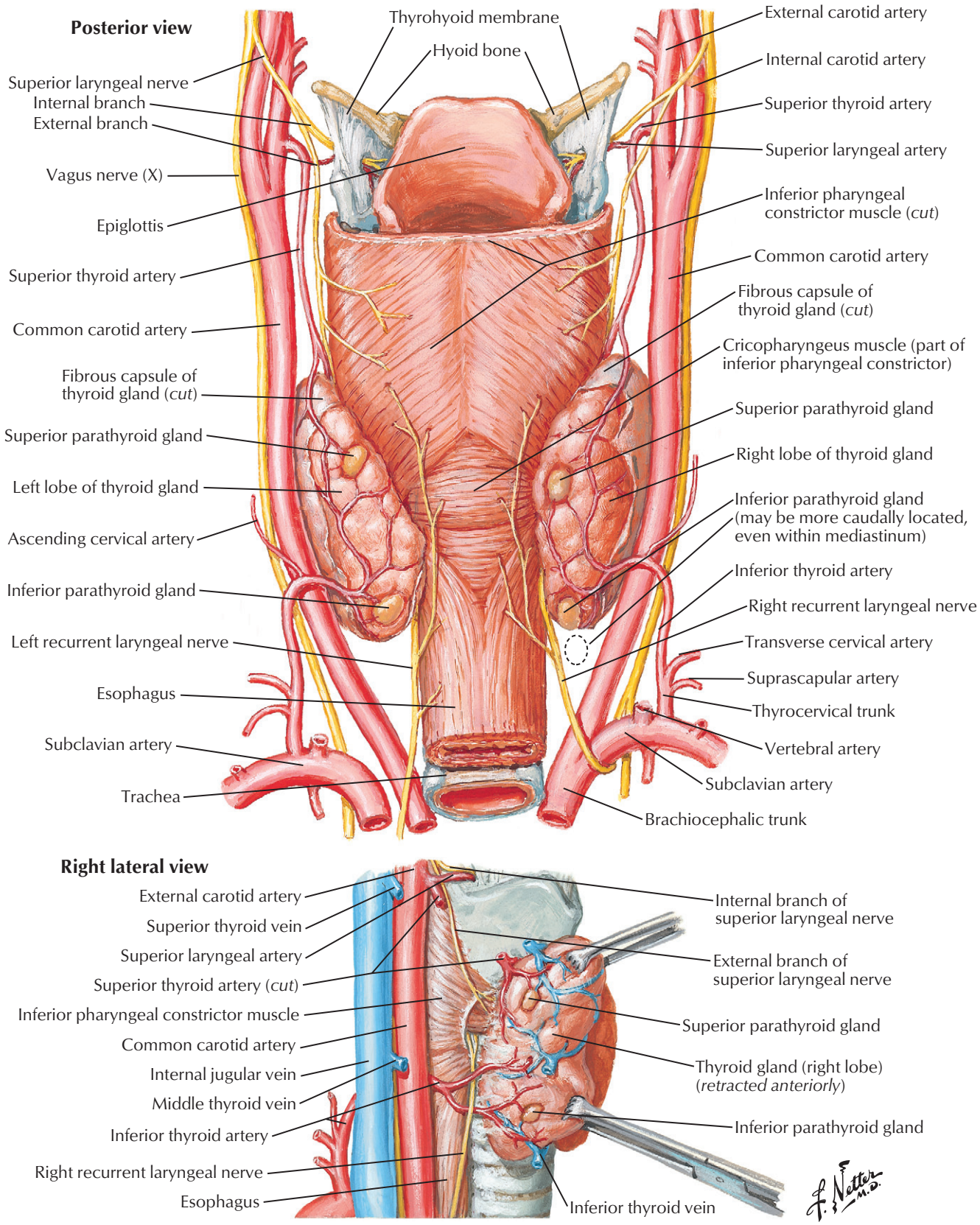
Thyroid Gland: Anterior View

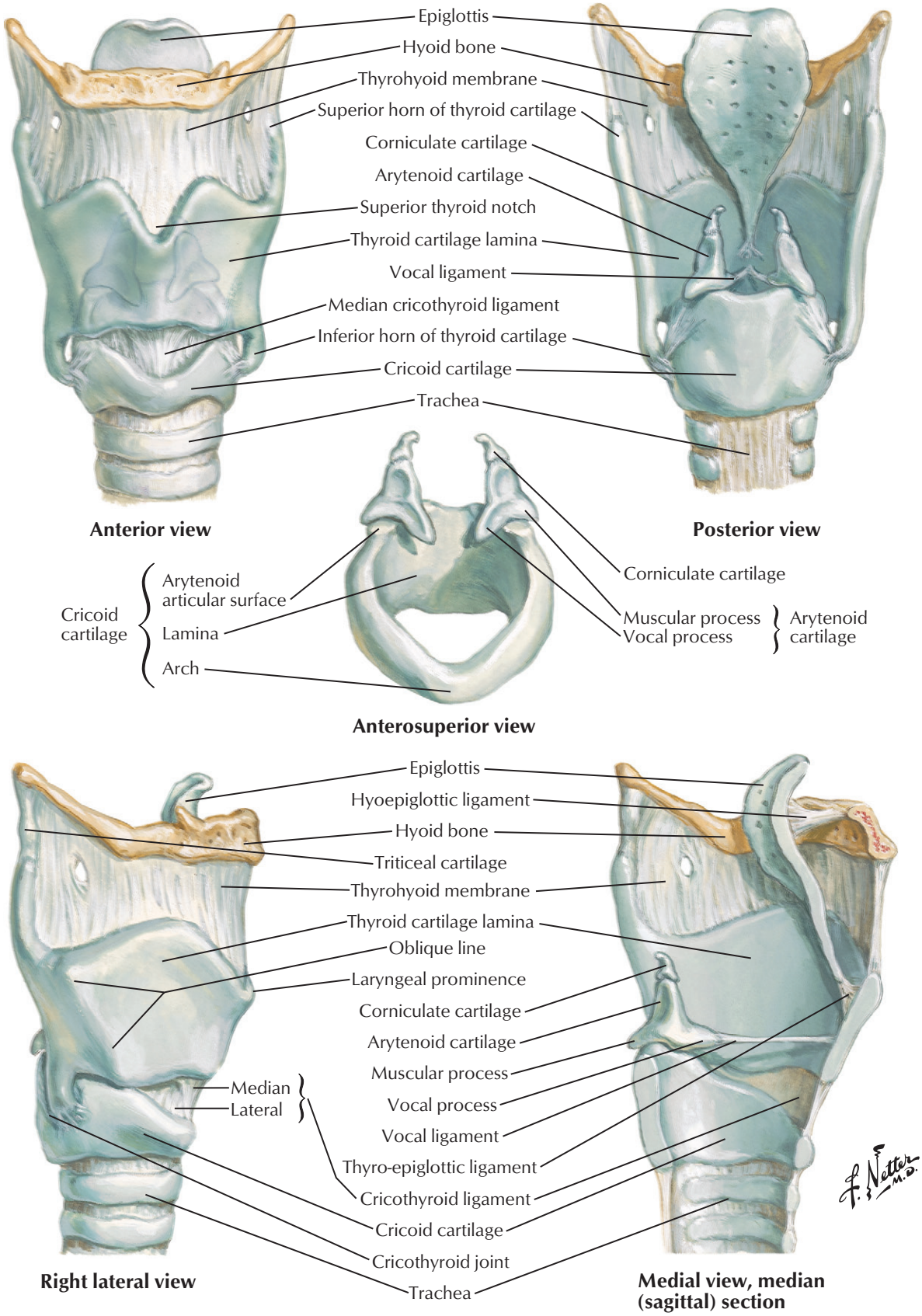


Thyroid Gland and Pharynx: Posterior View

See also Plate 78

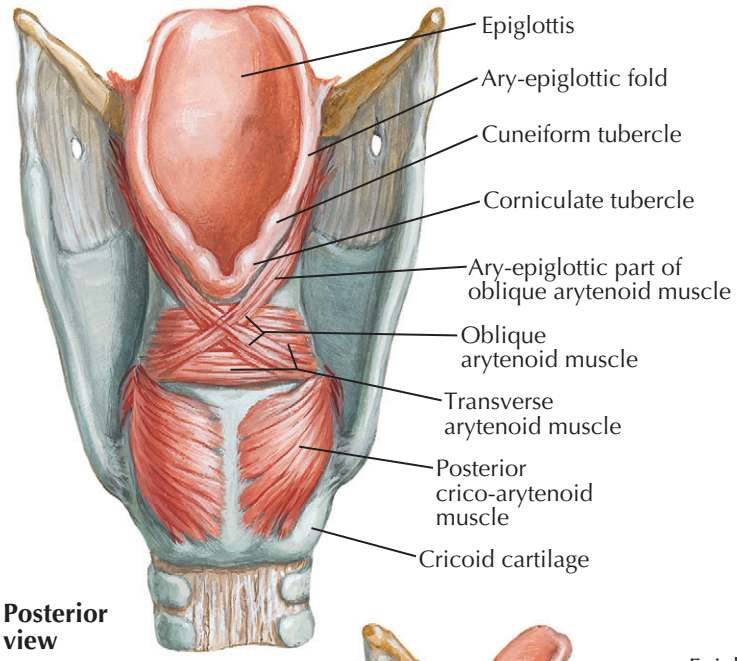



Posterior view
Thyrohyoid membrane
Hyoid bone
External carotid artery
Internal carotid artery
Superior thyroid artery
Superior laryngeal artery
Inferior pharyngeal constrictor muscle (cut)
Common carotid artery
Fibrous capsule of thyroid gland (cut)
Cricopharyngeus muscle (part of inferior pharyngeal constrictor)
Superior parathyroid gland
Right lobe of thyroid gland
Inferior parathyroid gland (may be more caudally located, even within mediastinum)
Inferior thyroid artery
Right recurrent laryngeal nerve
Transverse cervical artery
Suprascapular artery
Thyrocervical trunk
Vertebral artery
Subclavian artery
Brachiocephalic trunk
Superior laryngeal nerve
Internal branch
External branch
Vagus nerve (X)
Epiglottis
Superior thyroid artery
Common carotid artery
Fibrous capsule of thyroid gland (cut)
Superior parathyroid gland
Left lobe of thyroid gland
Ascending cervical artery
Inferior parathyroid gland
Left recurrent laryngeal nerve
Esophagus
Subclavian artery
Trachea
Right lateral view
External carotid artery
Superior thyroid vein
Superior laryngeal artery
Superior thyroid artery (cut)
Inferior pharyngeal constrictor muscle
Common carotid artery
Internal jugular vein
Middle thyroid vein
Inferior thyroid artery
Right recurrent laryngeal nerve
Esophagus
Internal branch of superior laryngeal nerve
External branch of superior laryngeal nerve
Superior parathyroid gland
Thyroid gland (right lobe) (retracted anteriorly)
Inferior parathyroid gland
Inferior thyroid vein

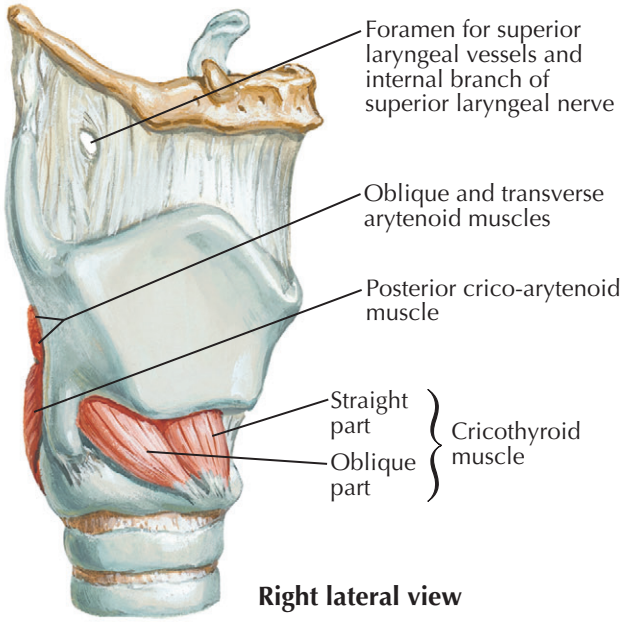

Epiglottis
Hyoid bone
Thyrohyoid membrane
Superior horn of thyroid cartilage
Corniculate cartilage
Arytenoid cartilage
Superior thyroid notch
Thyroid cartilage lamina
Vocal ligament
Median cricothyroid ligament
Inferior horn of thyroid cartilage
Cricoid cartilage
Trachea
Anterior view
Posterior view
Cricoid cartilage
Arytenoid articular surface
Lamina
Arch
Corniculate cartilage
Muscular process
Vocal process
Arytenoid cartilage
Anterosuperior view
Epiglottis
Hyoepiglottic ligament
Hyoid bone
Triticeal cartilage
Thyrohyoid membrane
Thyroid cartilage lamina
Oblique line
Laryngeal prominence
Corniculate cartilage
Arytenoid cartilage
Muscular process
Vocal process
Vocal ligament
Thyro-epiglottic ligament
Cricothyroid ligament
Cricoid cartilage
Cricothyroid joint
Trachea
Median
Lateral
Right lateral view
Medial view, median (sagittal) section

Intrinsic Muscles of Larynx

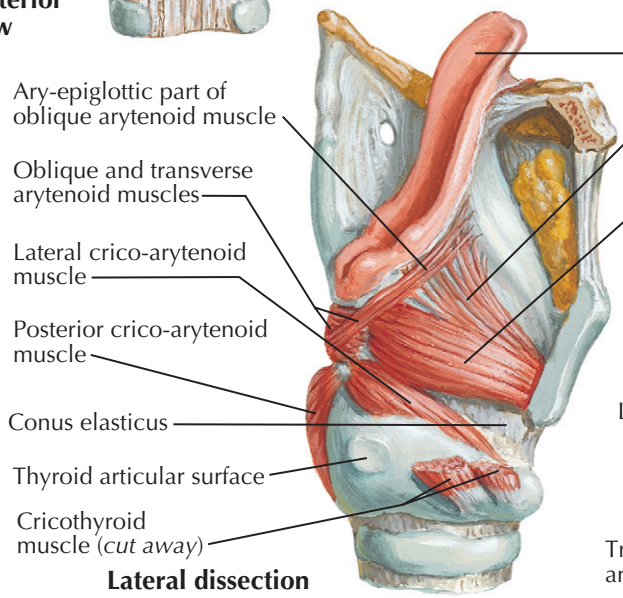
See also Plates 79, 81, 82



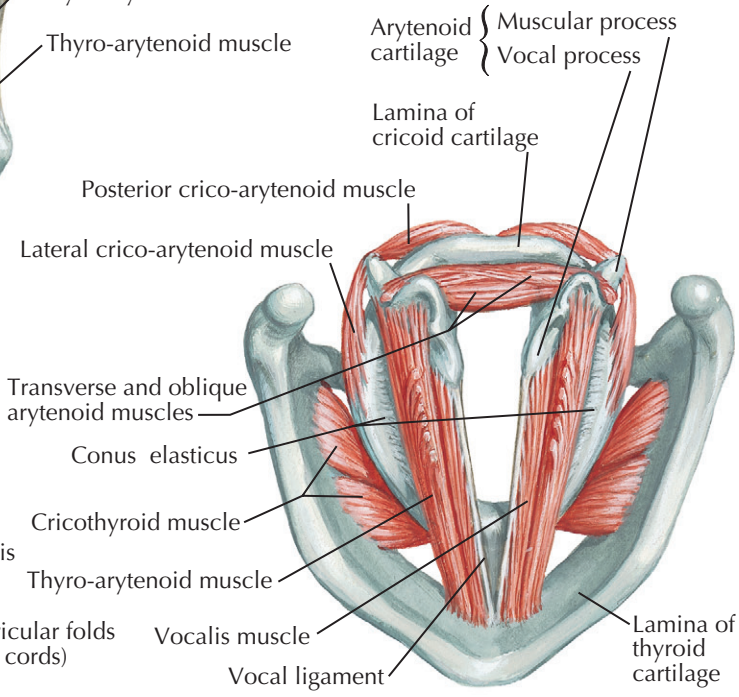
Posterior view



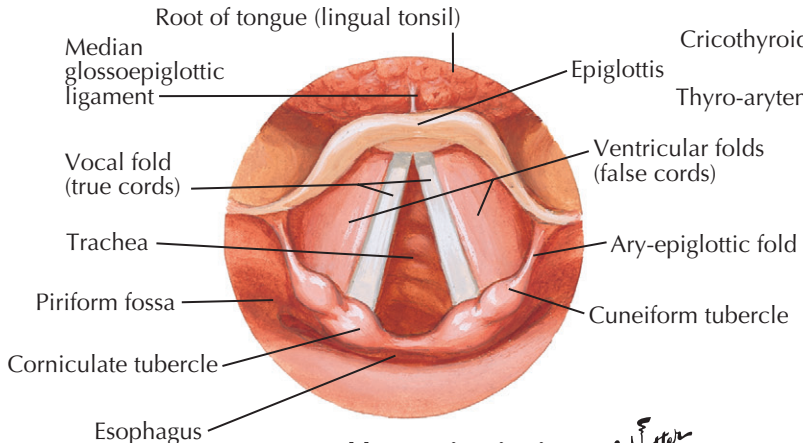
Right lateral view



Lateral dissection



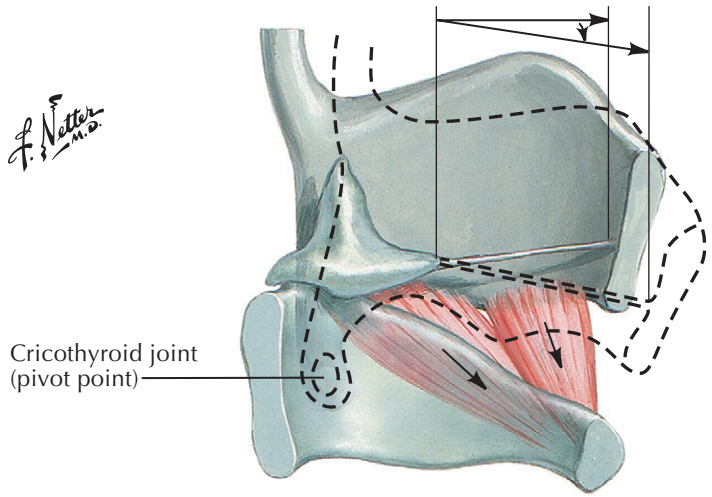
Superior view



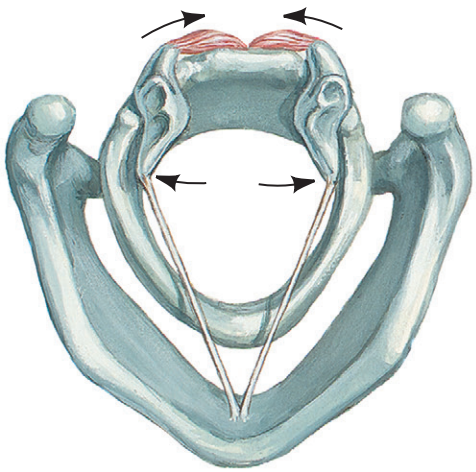
Normal larynx: inspiration

Action of Intrinsic Muscles of Larynx

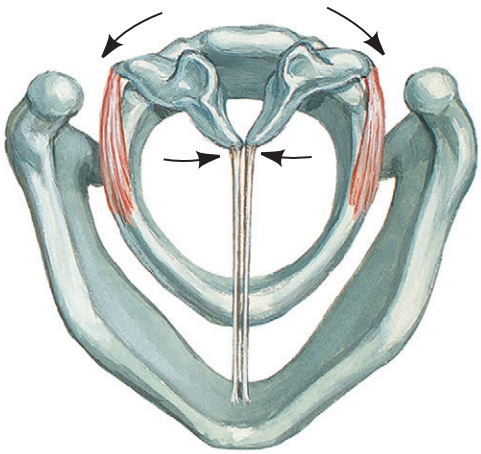
See also Plates 79, 80, 82



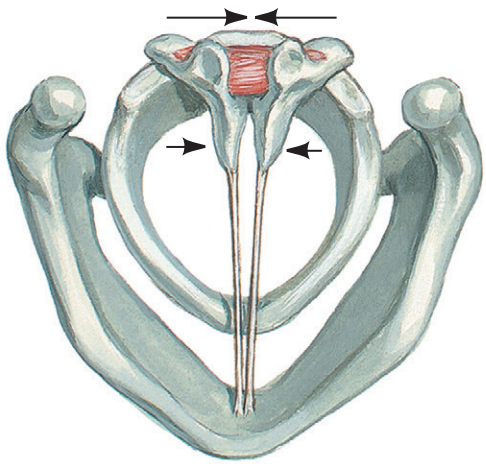
Action of cricothyroid muscles
Lengthening (increasing tension) of vocal ligaments



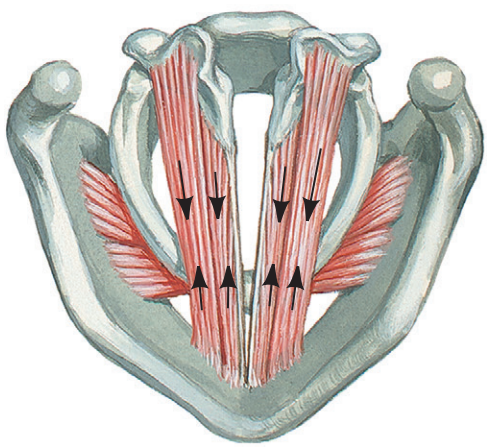
Action of posterior crico-arytenoid muscles
Abduction of vocal ligaments



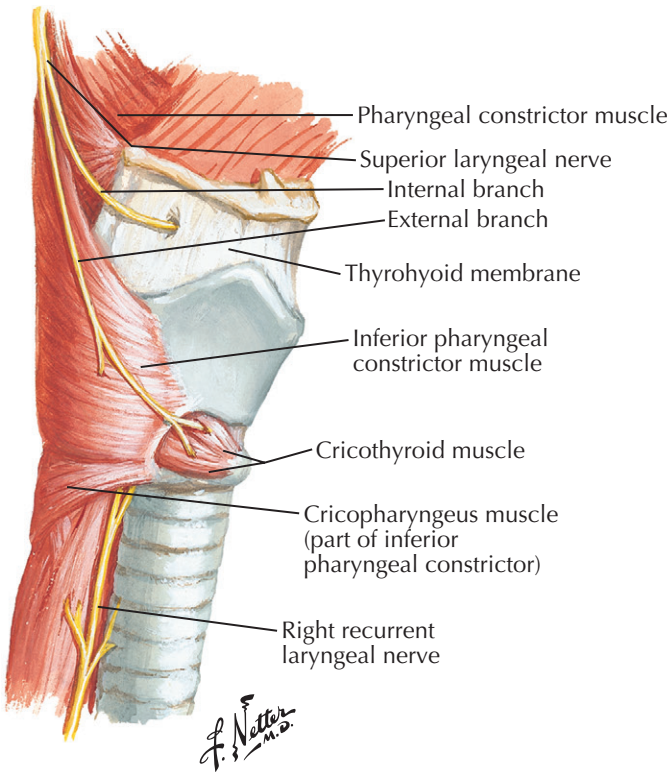
Action of lateral crico-arytenoid muscles
Adduction of vocal ligaments

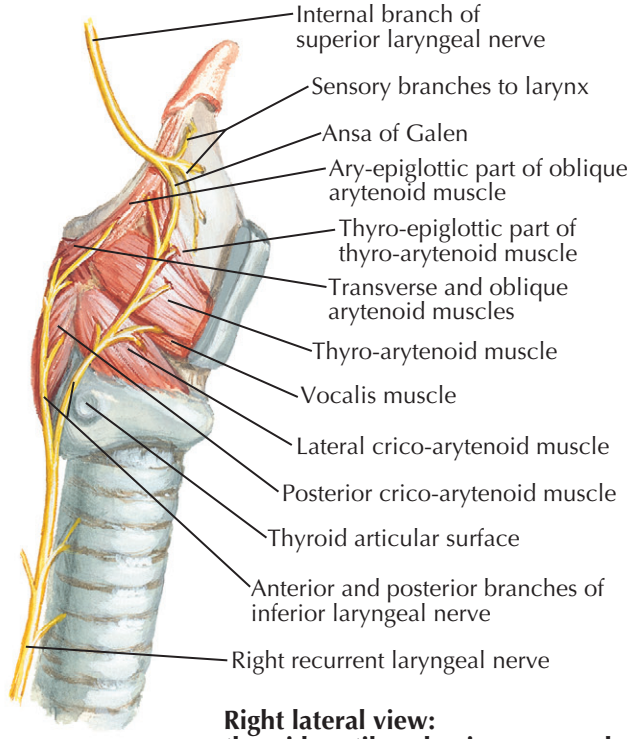


Action of transverse and oblique arytenoid muscles
Adduction of vocal ligaments



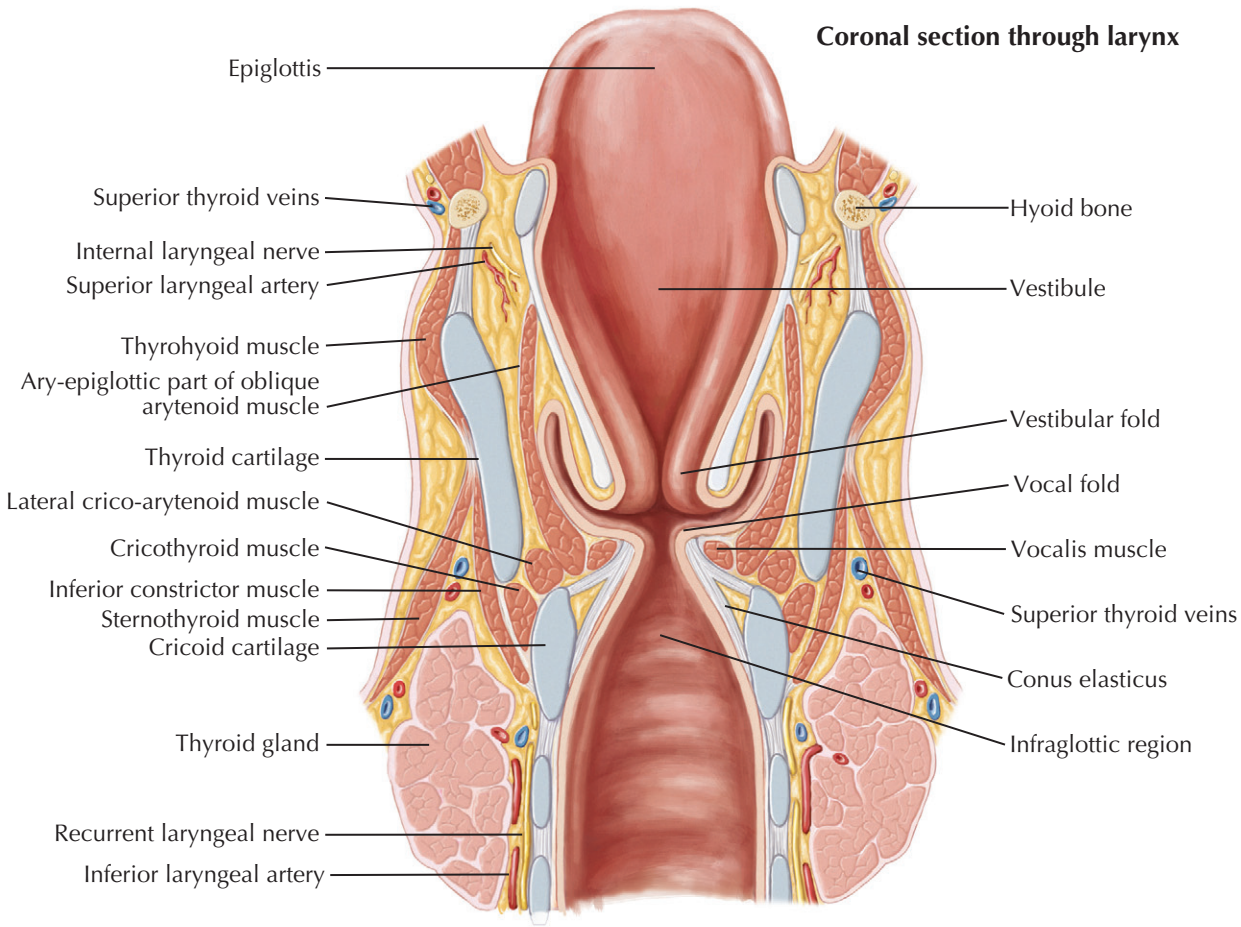
Action of vocalis and thyro-arytenoid muscles
Shortening (relaxation) of vocal ligaments

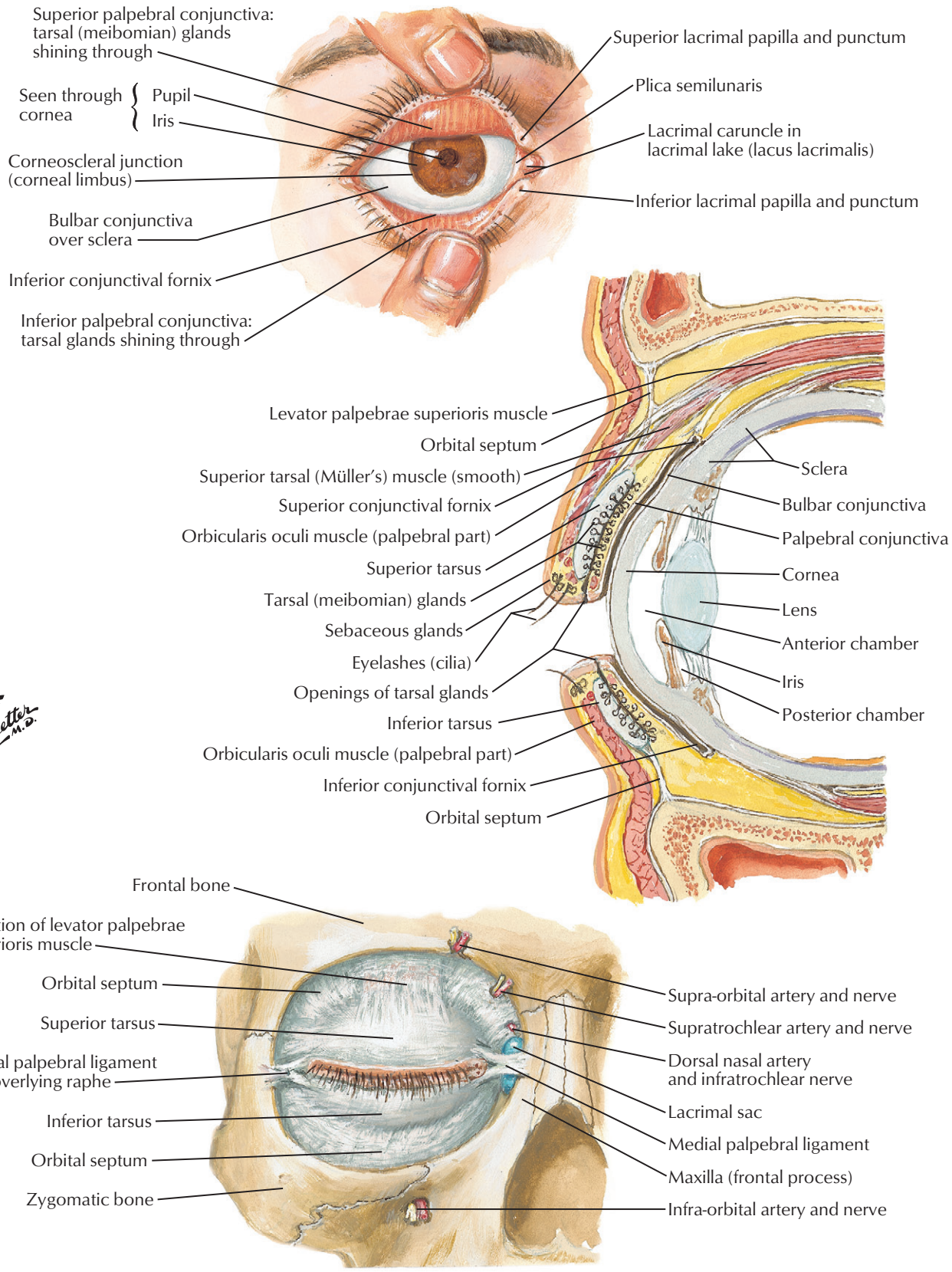




Right lateral view: thyroid cartilage lamina removed

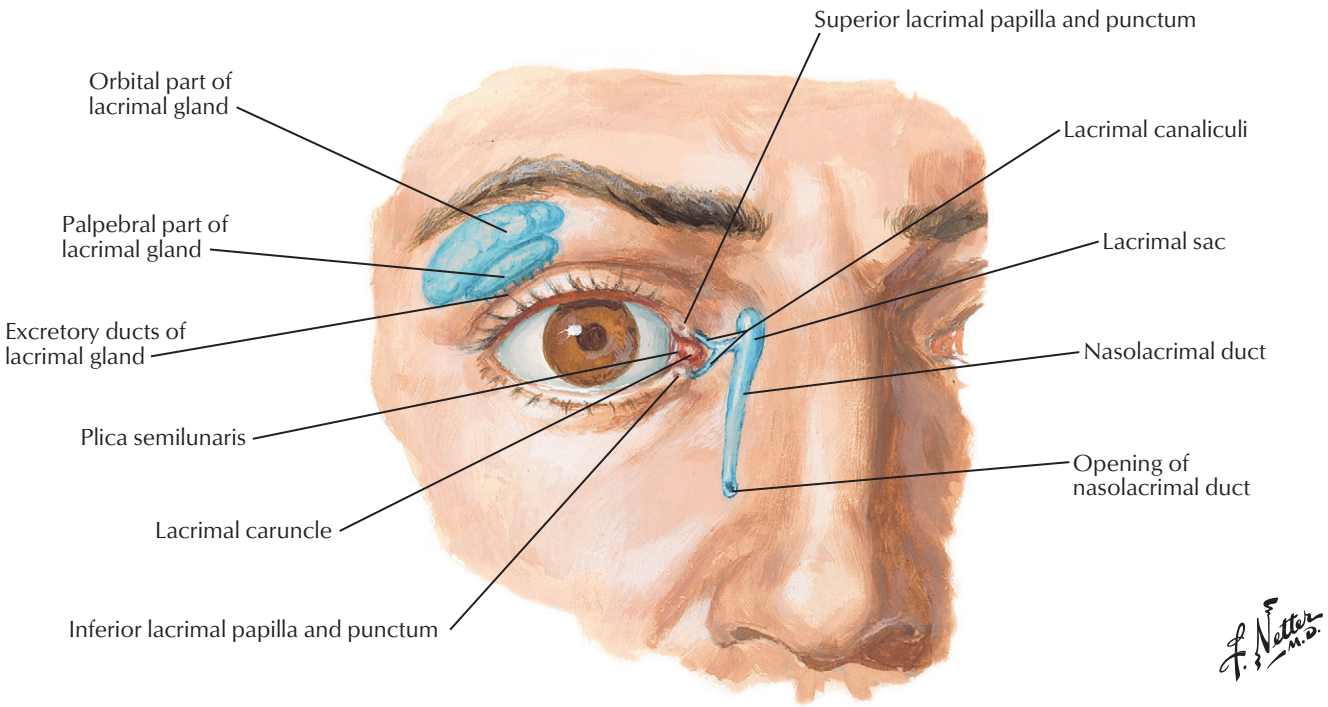
Coronal section through larynx

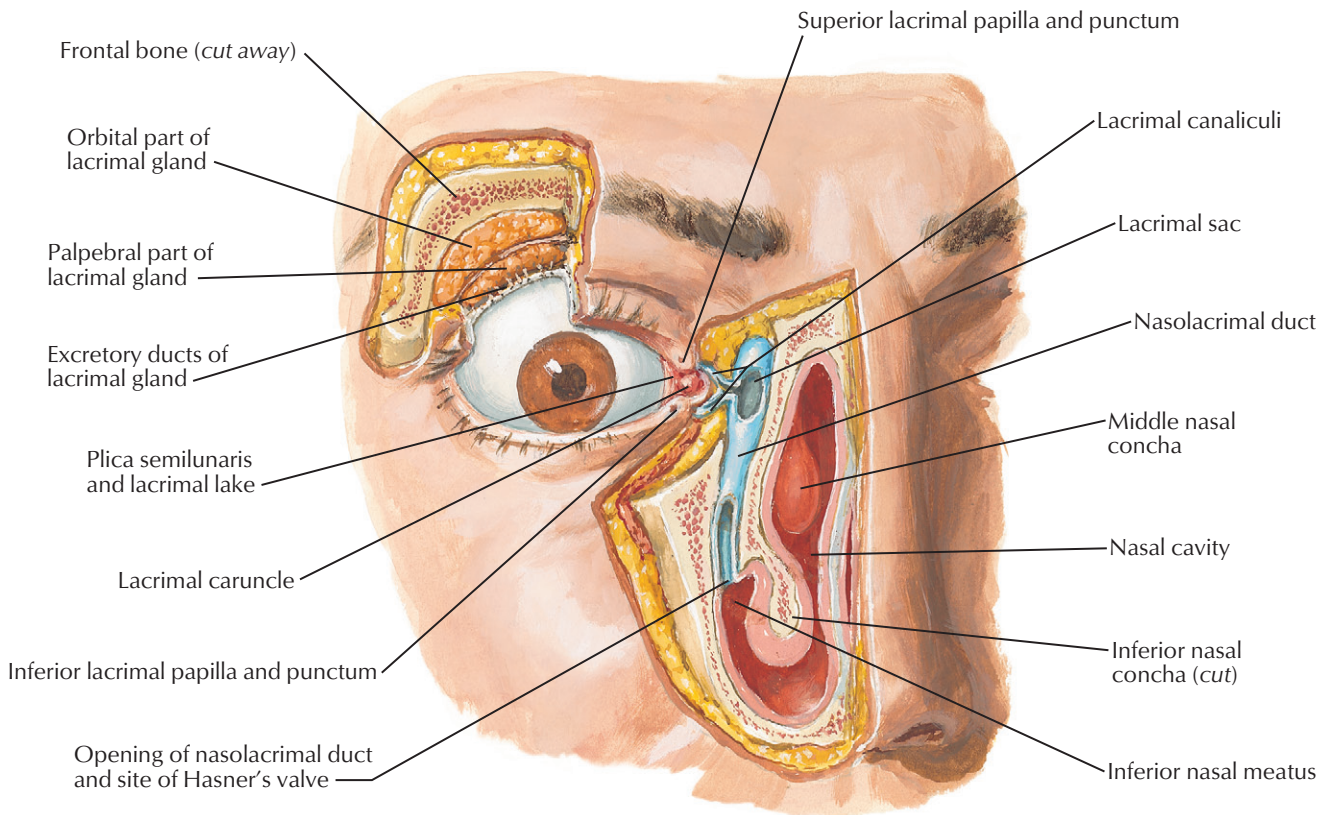



Superior palpebral conjunctiva: tarsal (meibomian) glands shining through
Seen through cornea
Pupil
Iris
Corneoscleral junction (corneal limbus)
Bulbar conjunctiva over sclera
Inferior conjunctival fornix
Inferior palpebral conjunctiva: tarsal glands shining through
Superior lacrimal papilla and punctum
Plica semilunaris
Lacrimal caruncle in lacrimal lake (lacus lacrimalis)
Inferior lacrimal papilla and punctum
Levator palpebrae superioris muscle
Orbital septum
Superior tarsal (Müller's) muscle (smooth)
Superior conjunctival fornix
Orbicularis oculi muscle (palpebral part)
Superior tarsus
Tarsal (meibomian) glands
Sebaceous glands
Eyelashes (cilia)
Openings of tarsal glands
Inferior tarsus
Orbicularis oculi muscle (palpebral part)
Inferior conjunctival fornix
Orbital septum
Sclera
Bulbar conjunctiva
Palpebral conjunctiva
Cornea
Lens
Anterior chamber
Iris
Posterior chamber
F. Netter M.D.
Frontal bone
Insertion of levator palpebrae superioris muscle
Orbital septum
Superior tarsus
Lateral palpebral ligament and overlying raphe
Inferior tarsus
Orbital septum
Zygomatic bone
Supra-orbital artery and nerve
Supratrochlear artery and nerve
Dorsal nasal artery and infratrochlear nerve
Lacrimal sac
Medial palpebral ligament
Maxilla (frontal process)
Infra-orbital artery and nerve

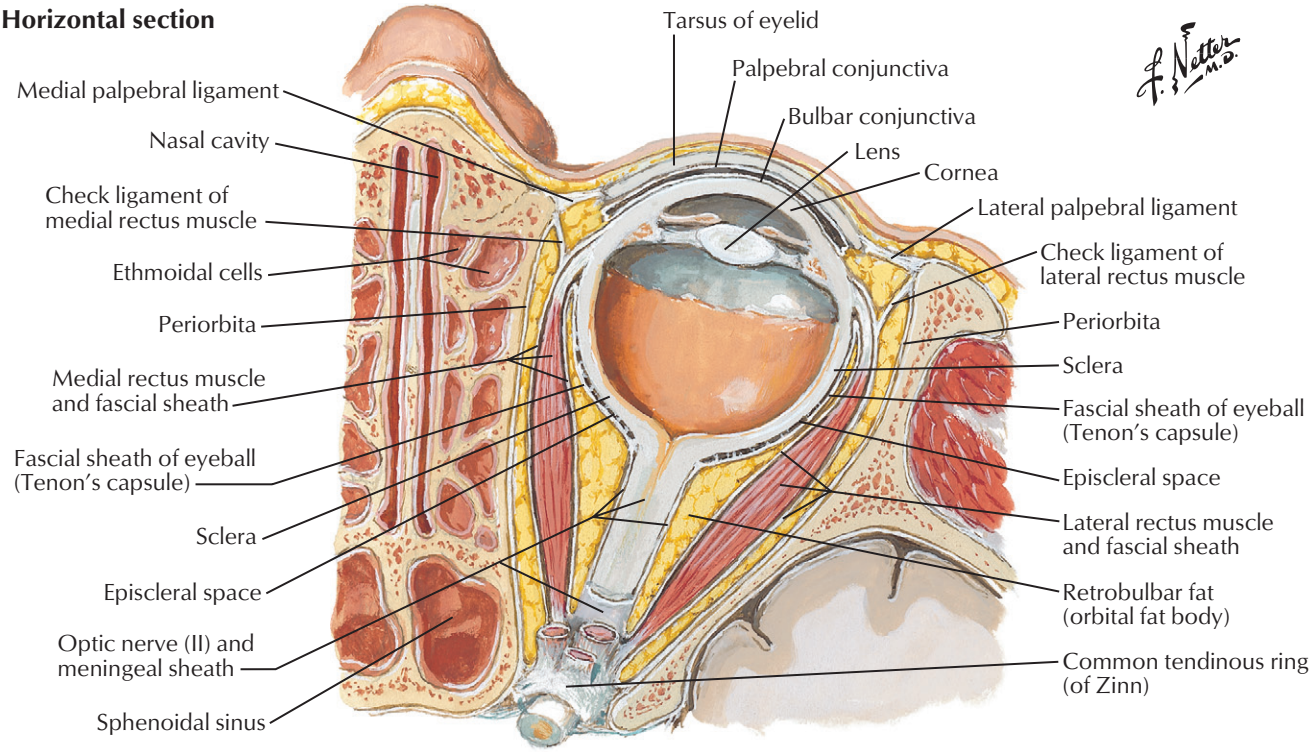
Lacrimal Apparatus

See also **Plate 134**

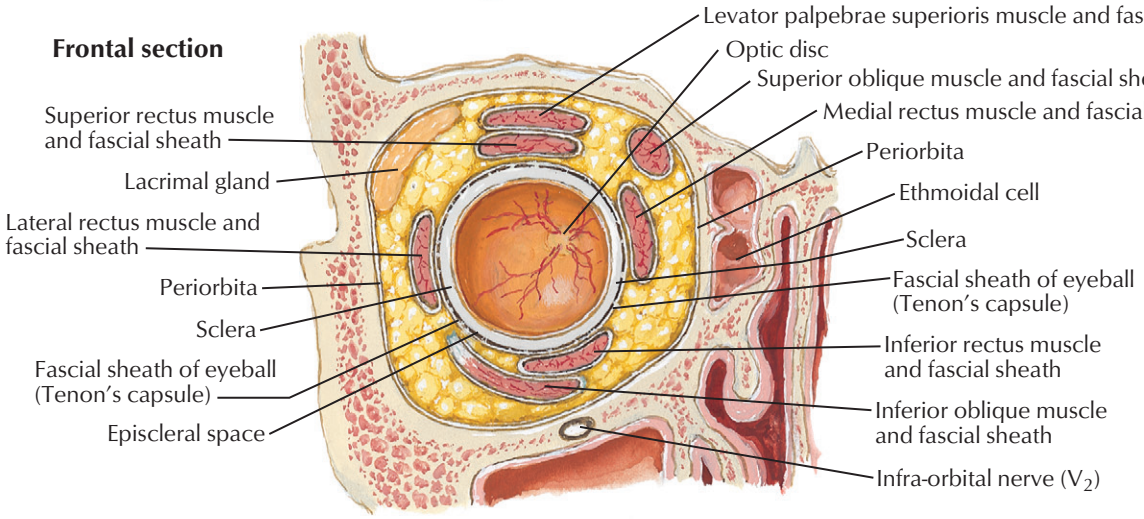




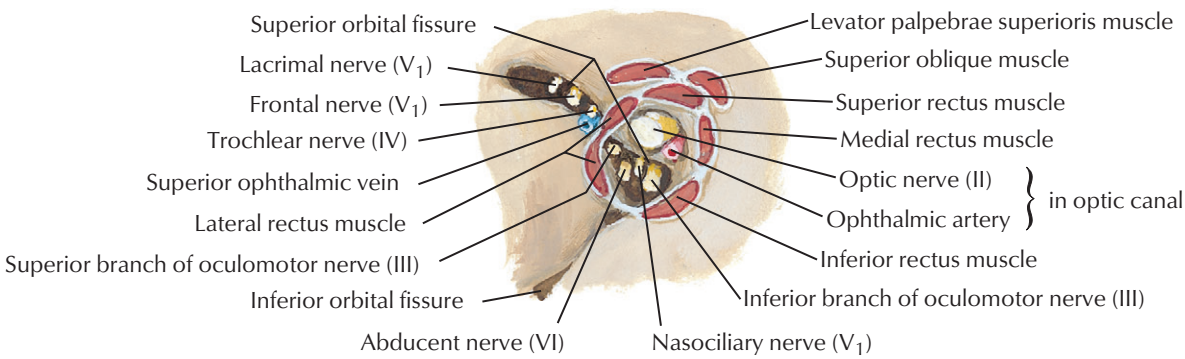
Horizontal section



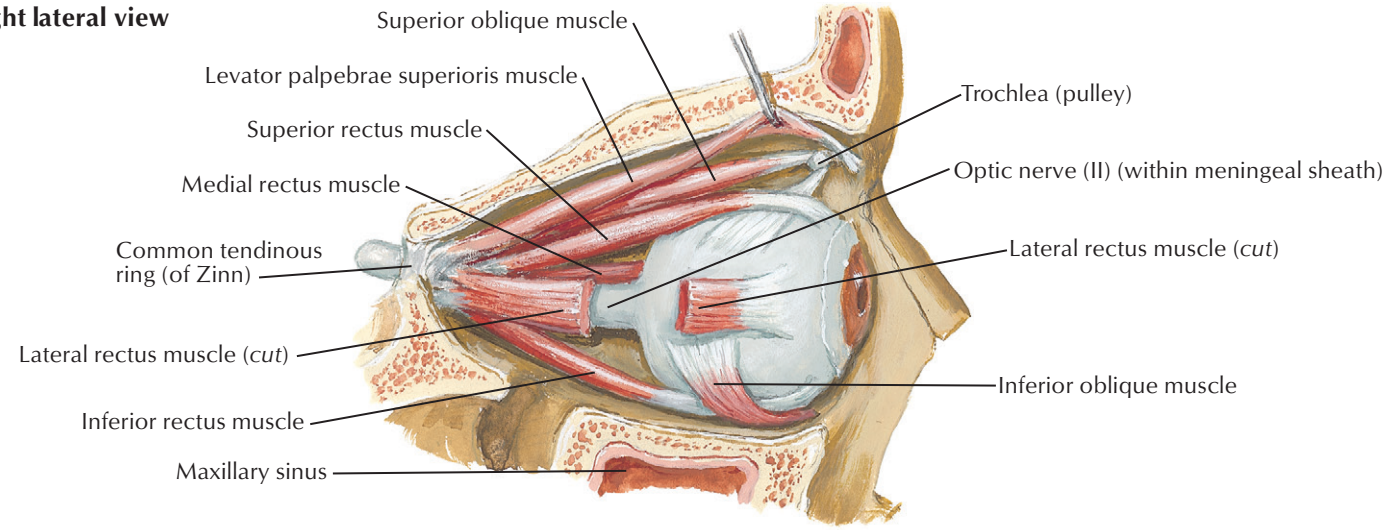
Frontal section



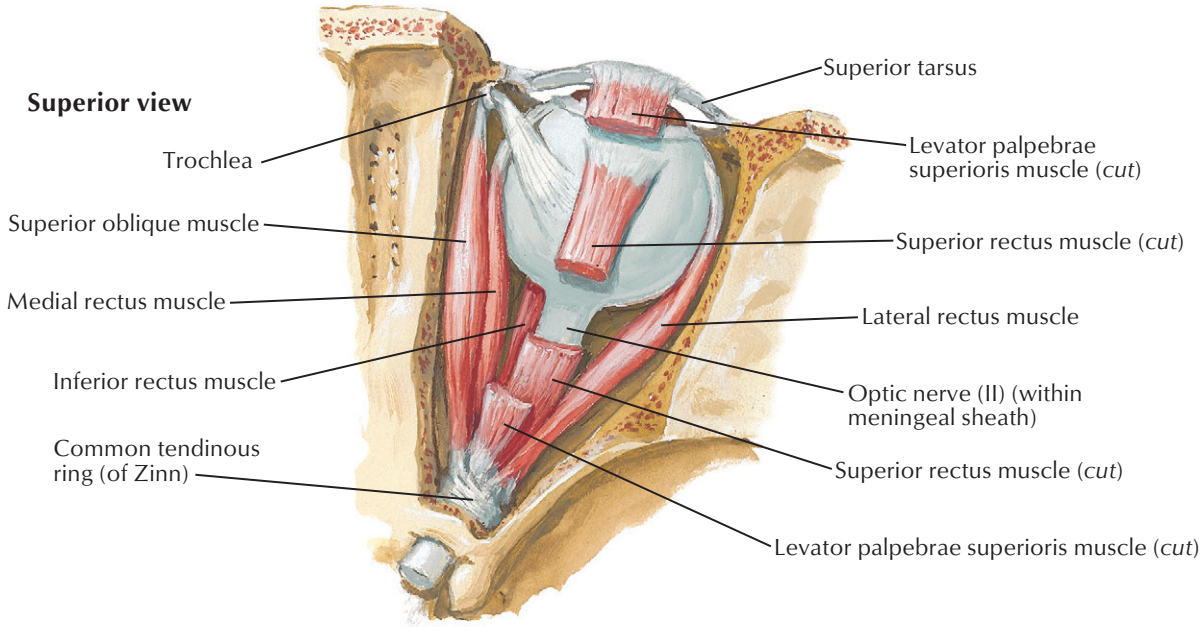
Muscle attachments and nerves and vessels entering orbit



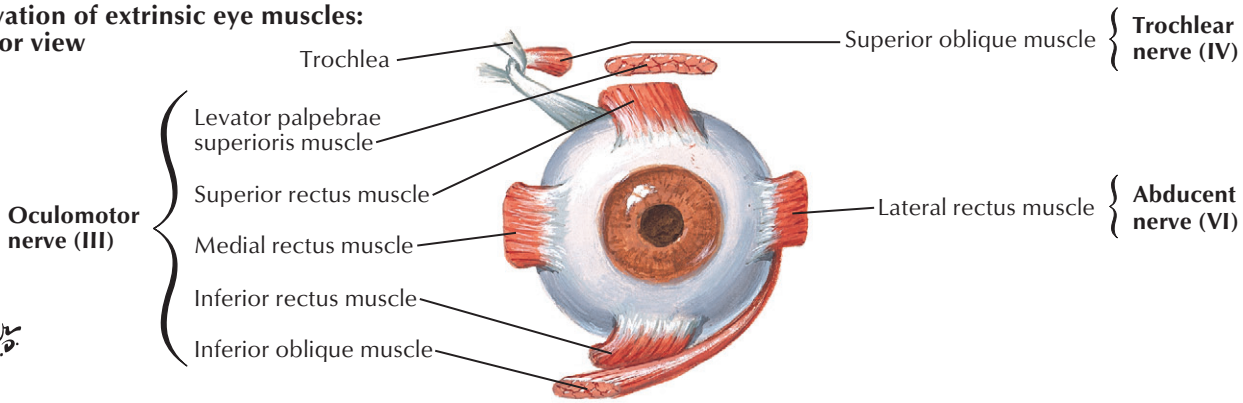
Right lateral view

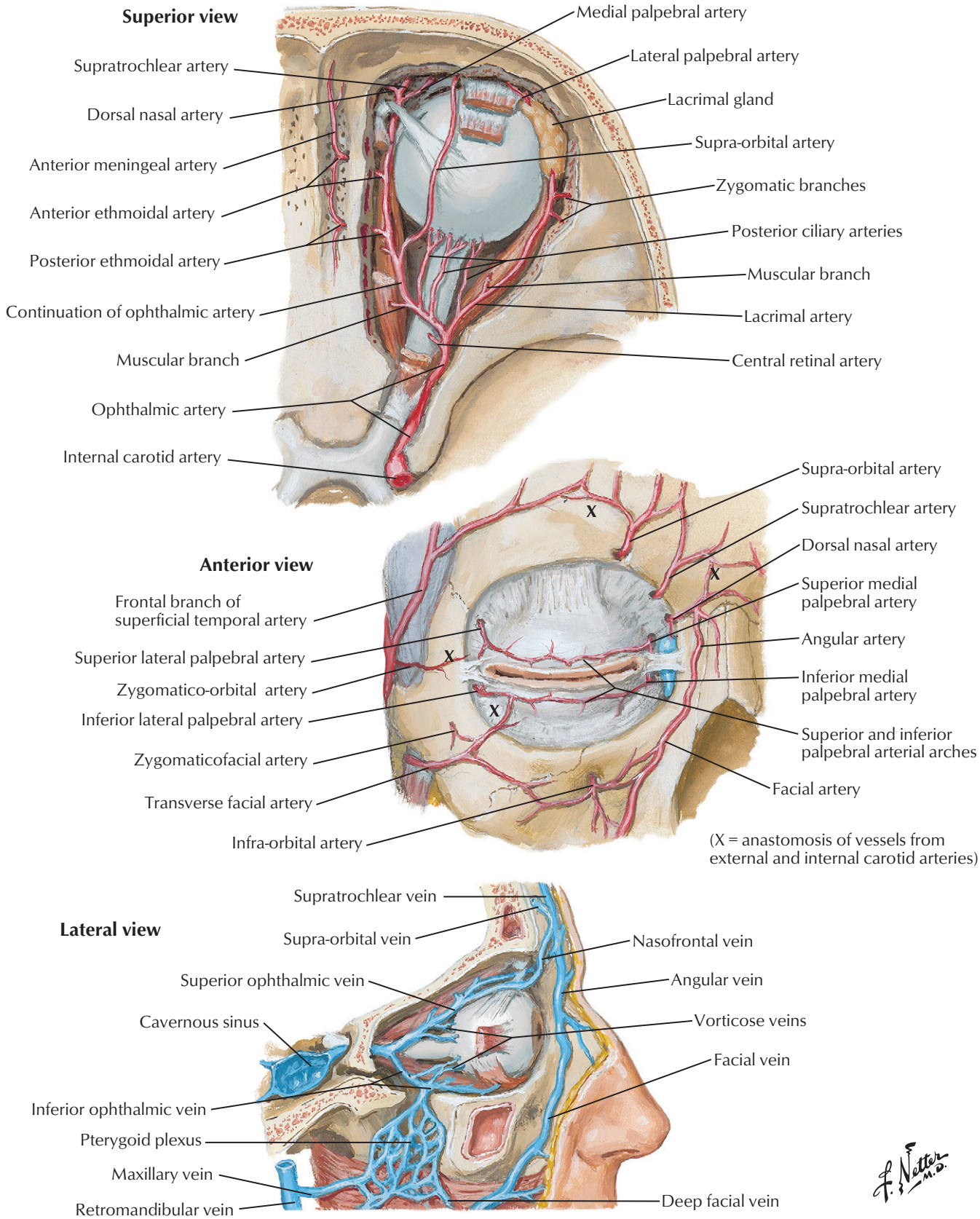


Superior view



Innervation of extrinsic eye muscles: anterior view

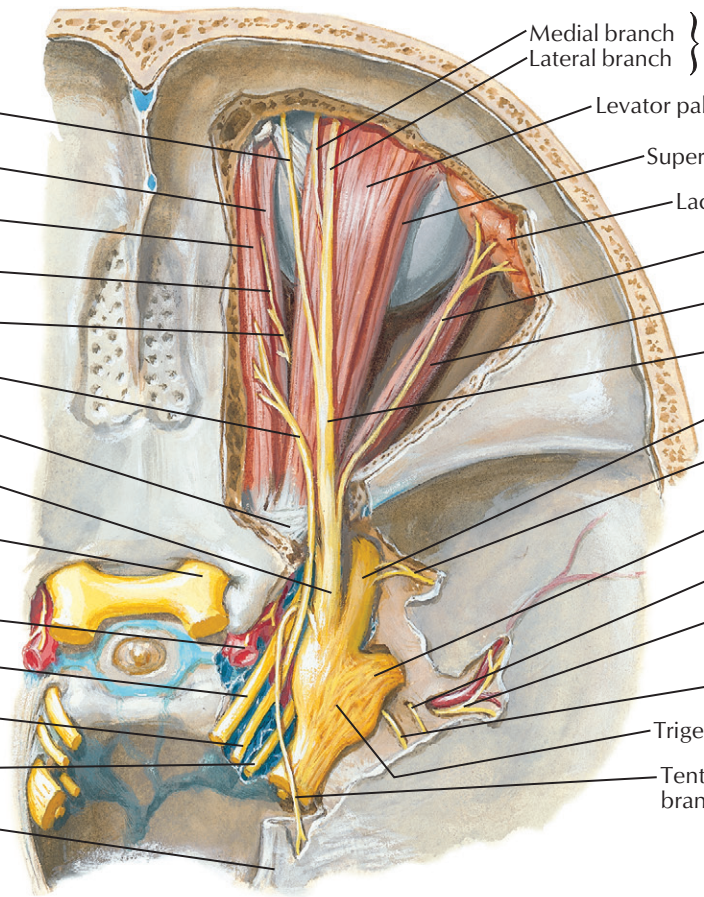



Superior view
Supratrochlear artery
Dorsal nasal artery
Anterior meningeal artery
Anterior ethmoidal artery
Posterior ethmoidal artery
Continuation of ophthalmic artery
Muscular branch
Ophthalmic artery
Internal carotid artery
Medial palpebral artery
Lateral palpebral artery
Lacrimal gland
Supra-orbital artery
Zygomatic branches
Posterior ciliary arteries
Muscular branch
Lacrimal artery
Central retinal artery
Anterior view
Frontal branch of superficial temporal artery
Superior lateral palpebral artery
Zygomatico-orbital artery
Inferior lateral palpebral artery
Zygomaticofacial artery
Transverse facial artery
Infra-orbital artery
X
Supra-orbital artery
Supratrochlear artery
Dorsal nasal artery
Superior medial palpebral artery
Angular artery
Inferior medial palpebral artery
Superior and inferior palpebral arterial arches
Facial artery
(X = anastomosis of vessels from external and internal carotid arteries)
Lateral view
Supratrochlear vein
Supra-orbital vein
Superior ophthalmic vein
Cavernous sinus
Inferior ophthalmic vein
Pterygoid plexus
Maxillary vein
Retromandibular vein
Nasofrontal vein
Angular vein
Vorticose veins
Facial vein
Deep facial vein

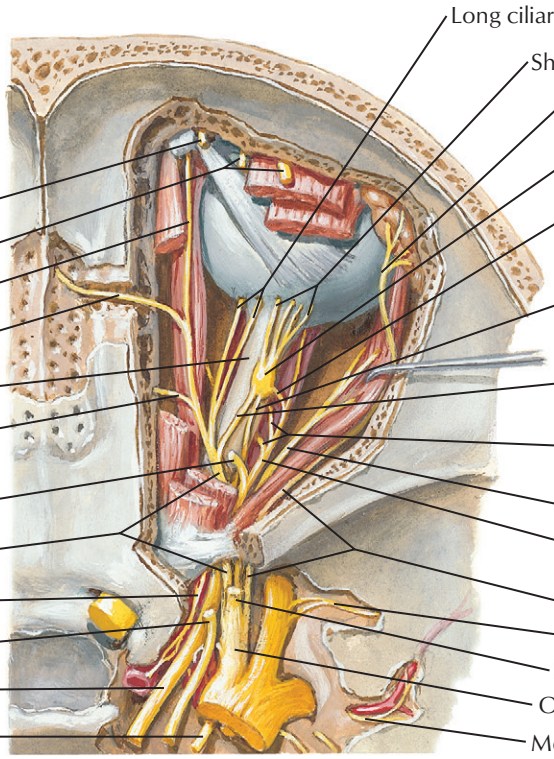
Nerves of Orbit

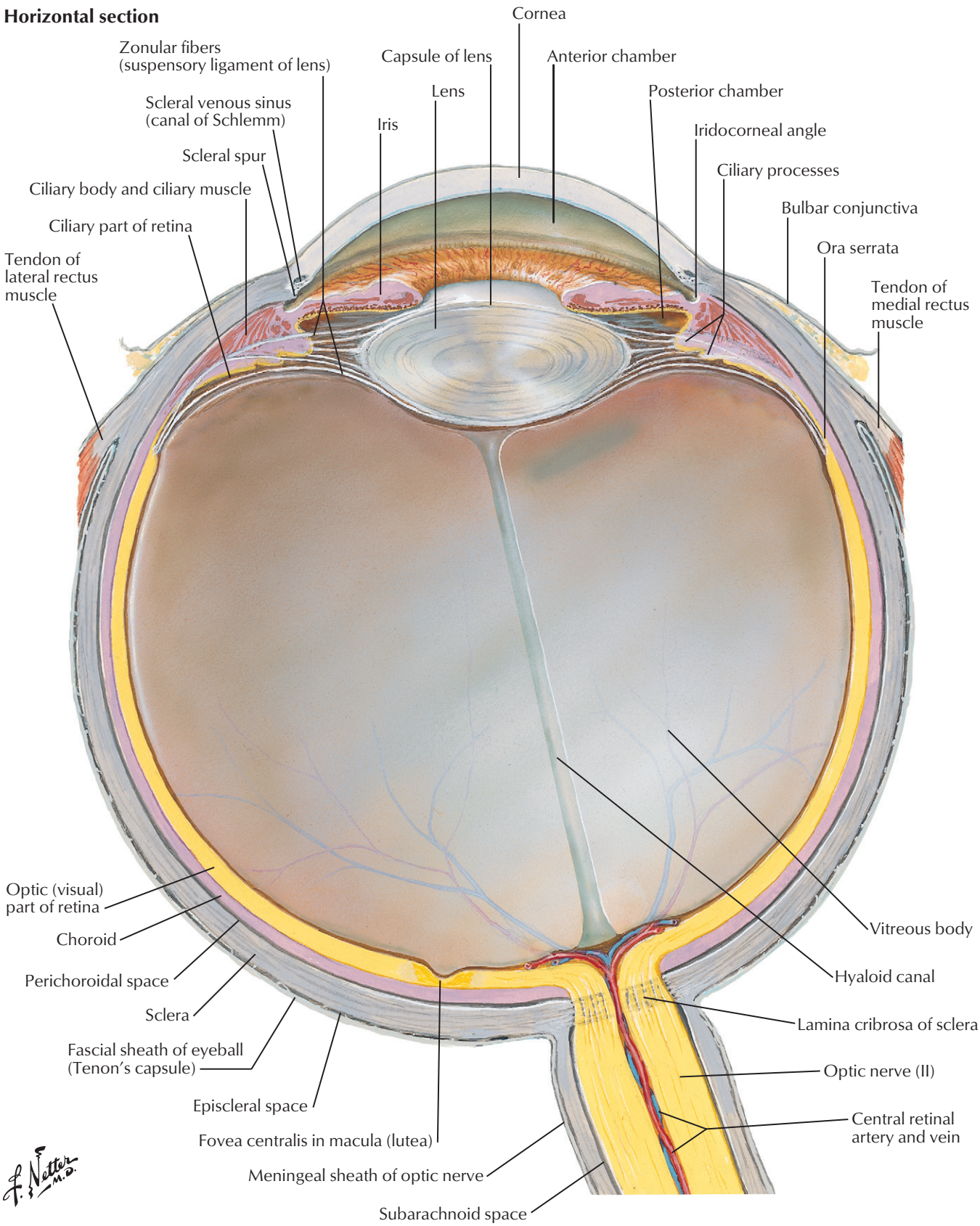
See also Plates 52, 122, 123

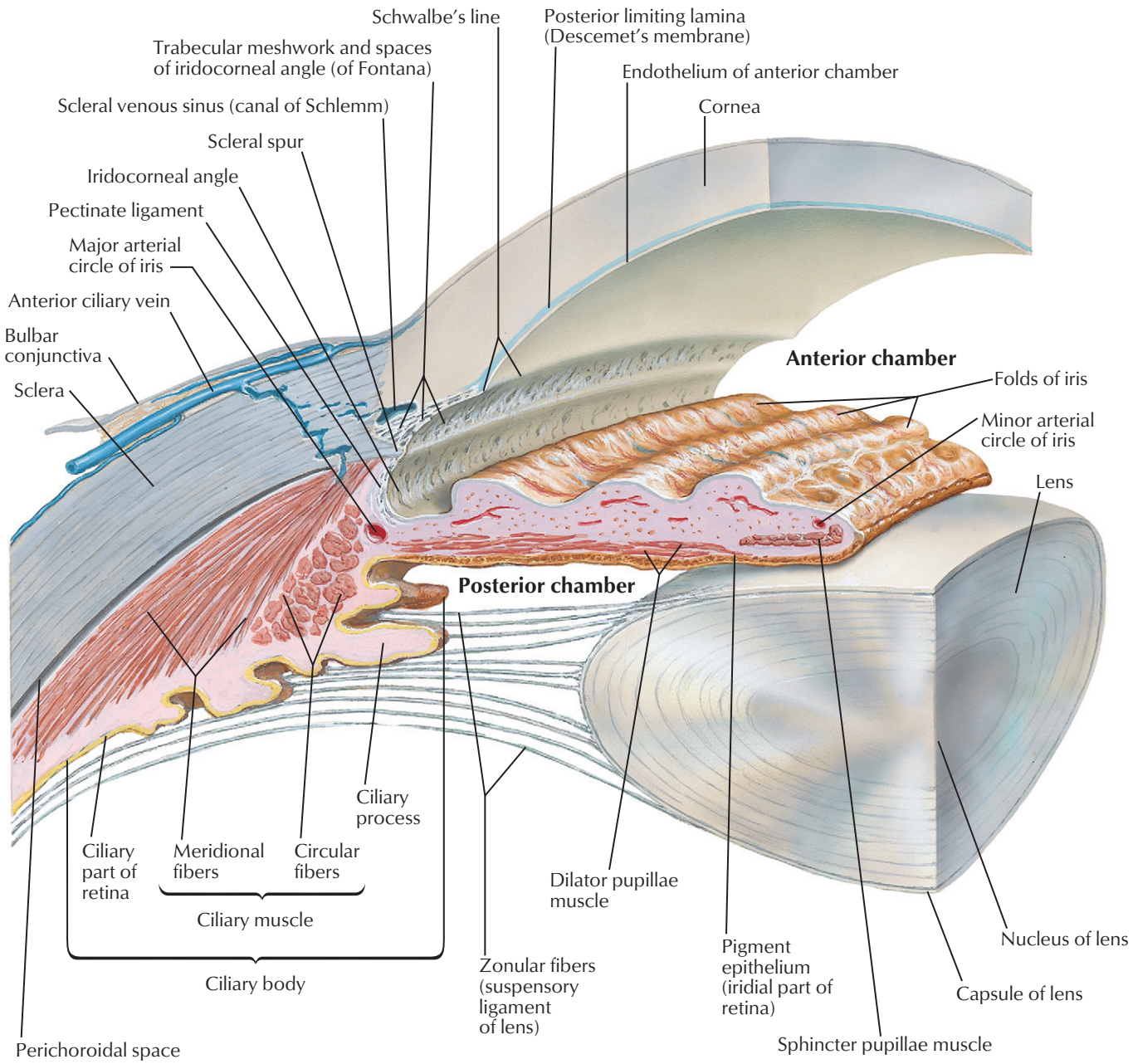
Superior view



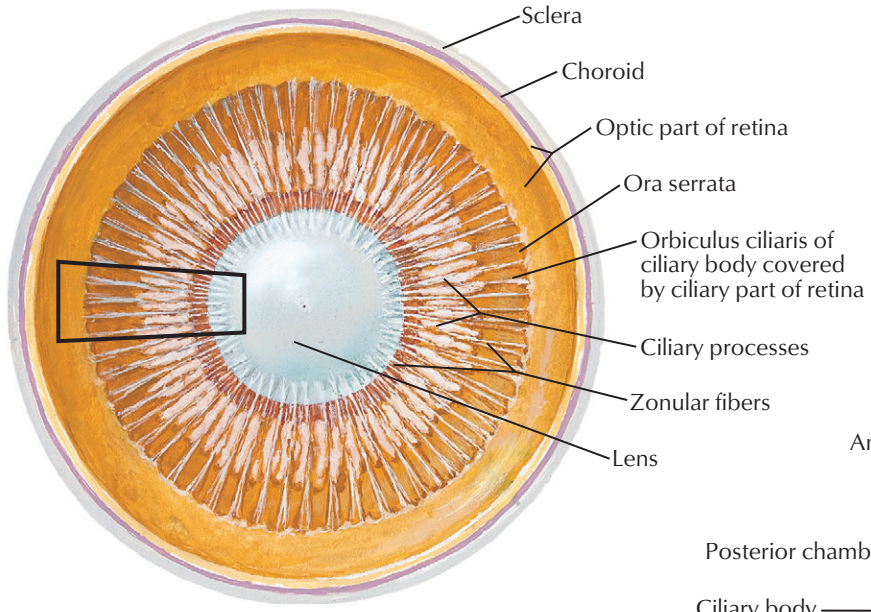
Superior view:
levator palpebrae superioris, superior rectus, and superior oblique muscles partially cut away



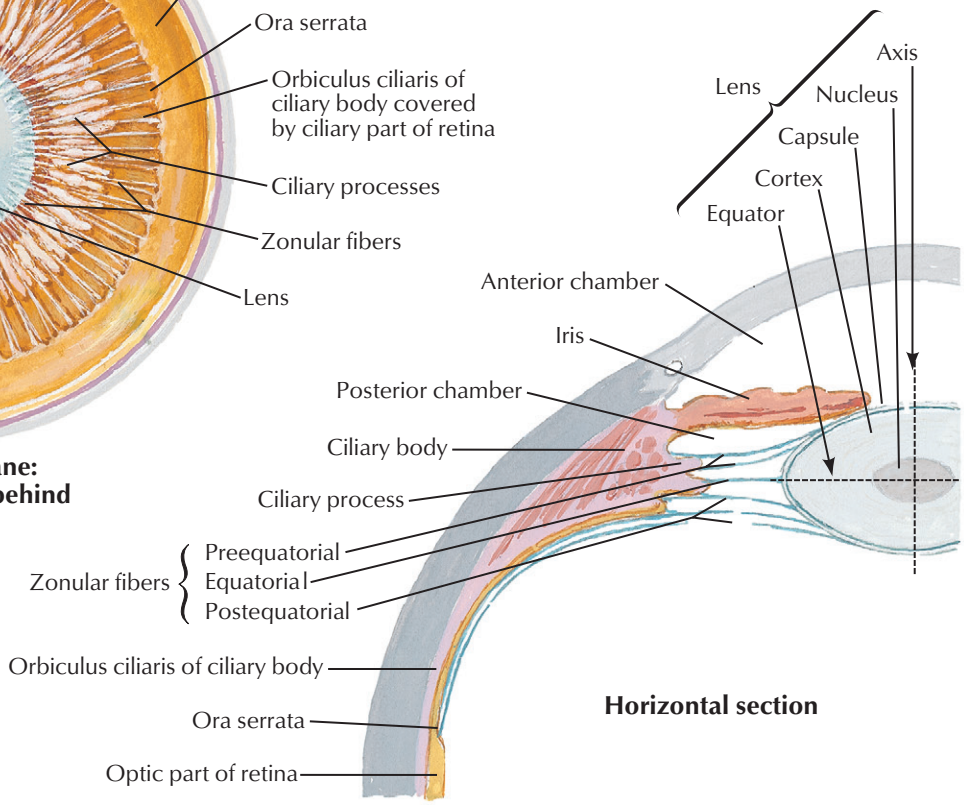

Horizontal section
Cornea
Zonular fibers
(suspensory ligament of lens)
Capsule of lens
Anterior chamber
Lens
Posterior chamber
Scleral venous sinus
(canal of Schlemm)
Iris
Iridocorneal angle
Scleral spur
Ciliary processes
Ciliary body and ciliary muscle
Bulbar conjunctiva
Ciliary part of retina
Ora serrata
Tendon of
lateral rectus
muscle
Tendon of
medial rectus
muscle
Optic (visual)
part of retina
Vitreous body
Choroid
Hyaloid canal
Perichoroidal space
Lamina cribrosa of sclera
Sclera
Optic nerve (II)
Fascial sheath of eyeball
(Tenon's capsule)
Central retinal
artery and vein
Episcleral space
Fovea centralis in macula (lutea)
Meningeal sheath of optic nerve
Subarachnoid space



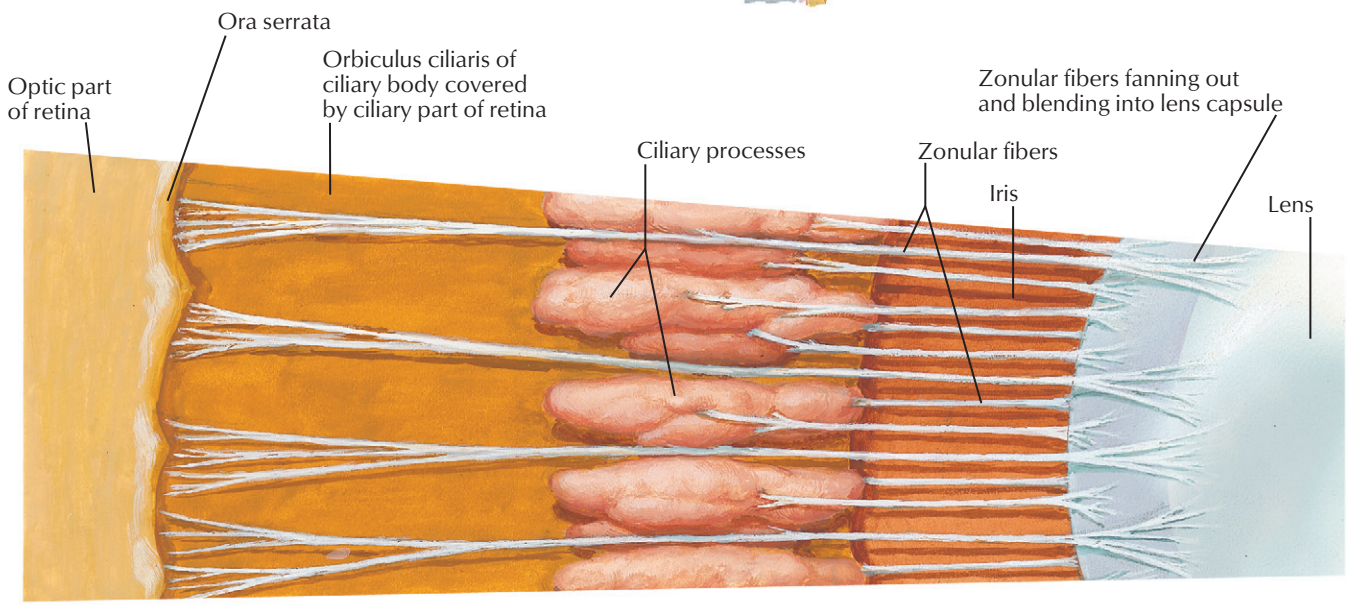
Note: For clarity, only single plane of zonular fibers shown; actually, fibers surround entire circumference of lens.



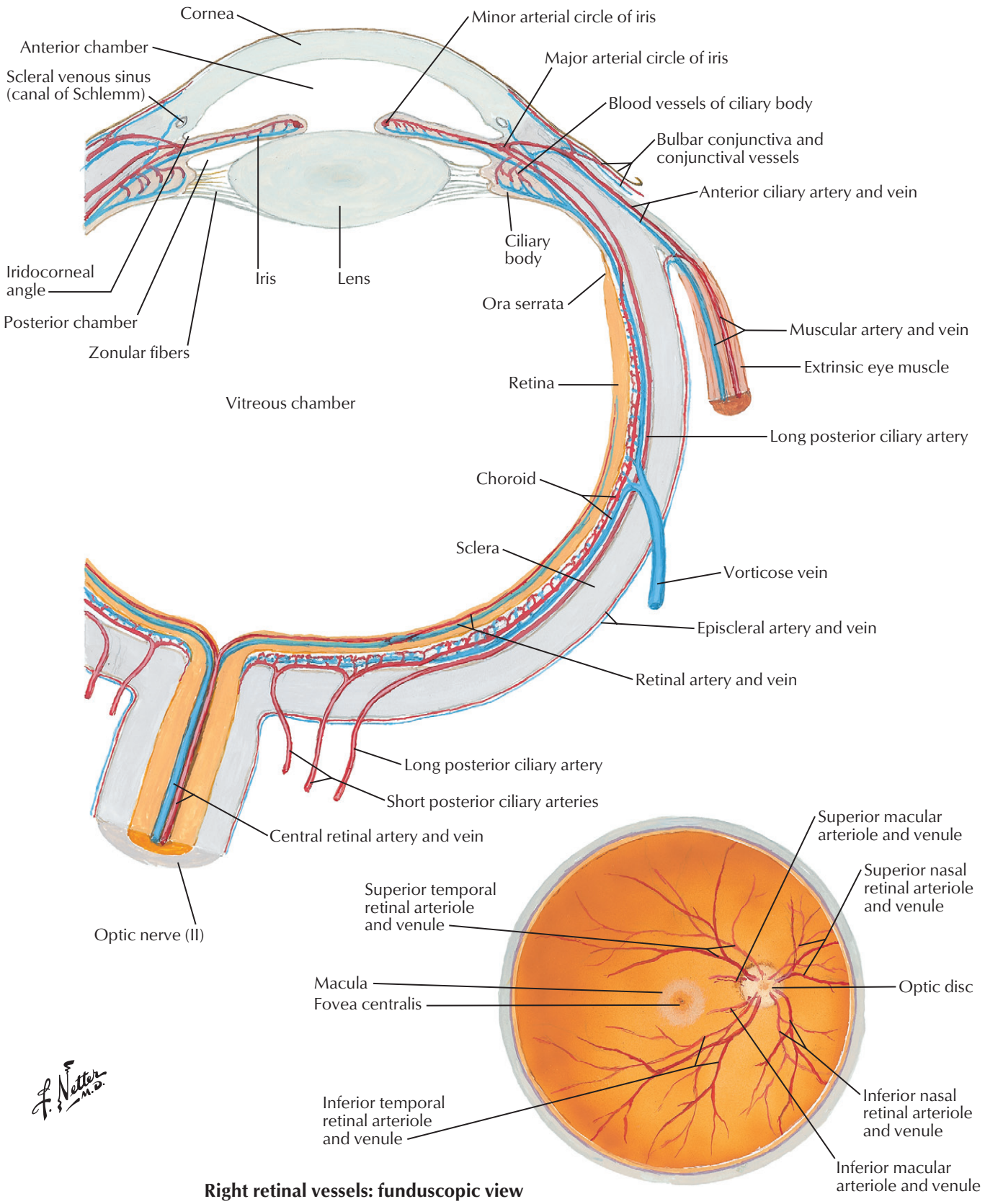
Eyeball sectioned in coronal plane: anterior segment viewed from behind



Horizontal section

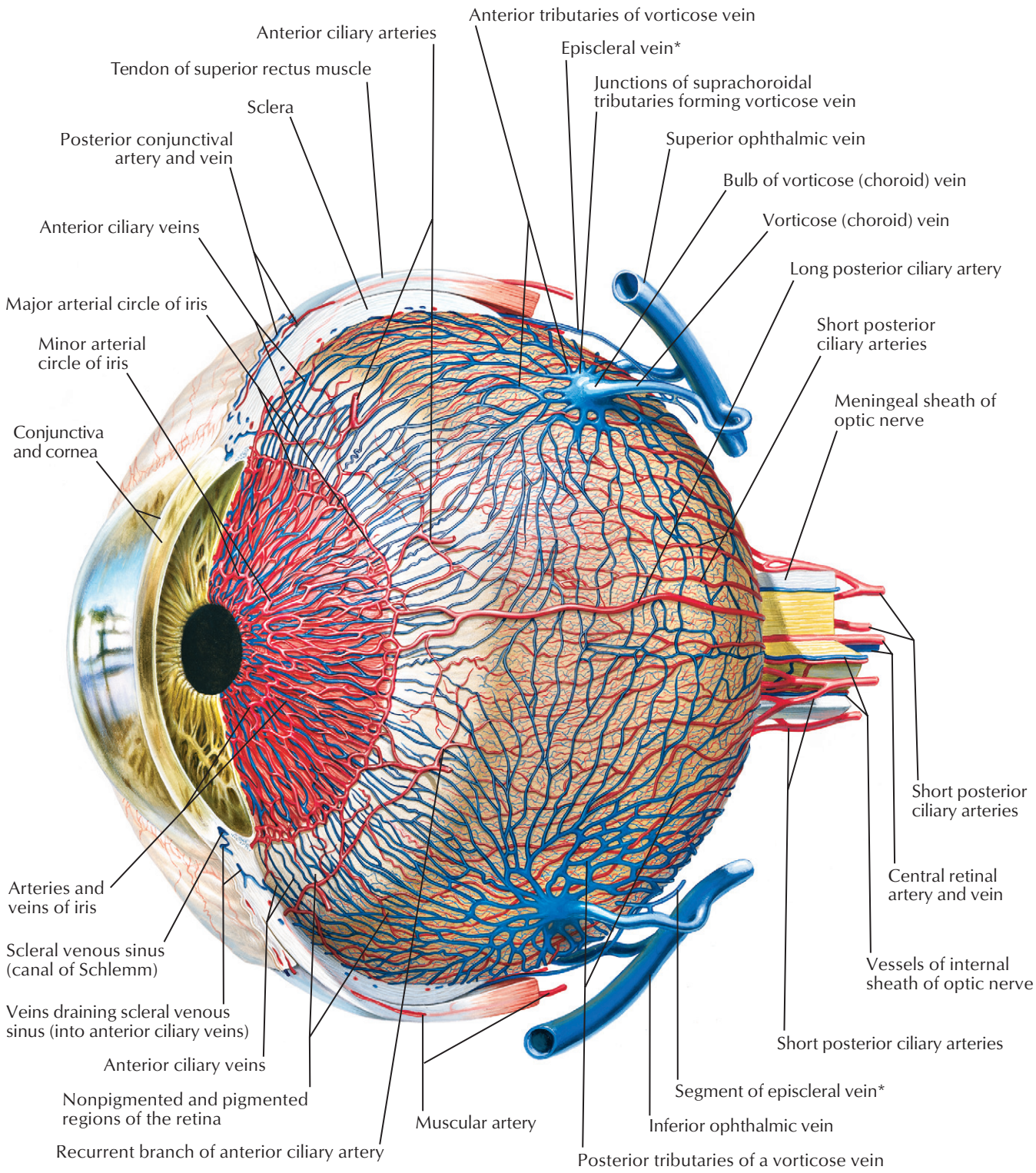


Enlargement of segment outlined in top illustration (semischematic)



Right retinal vessels: funduscopic view

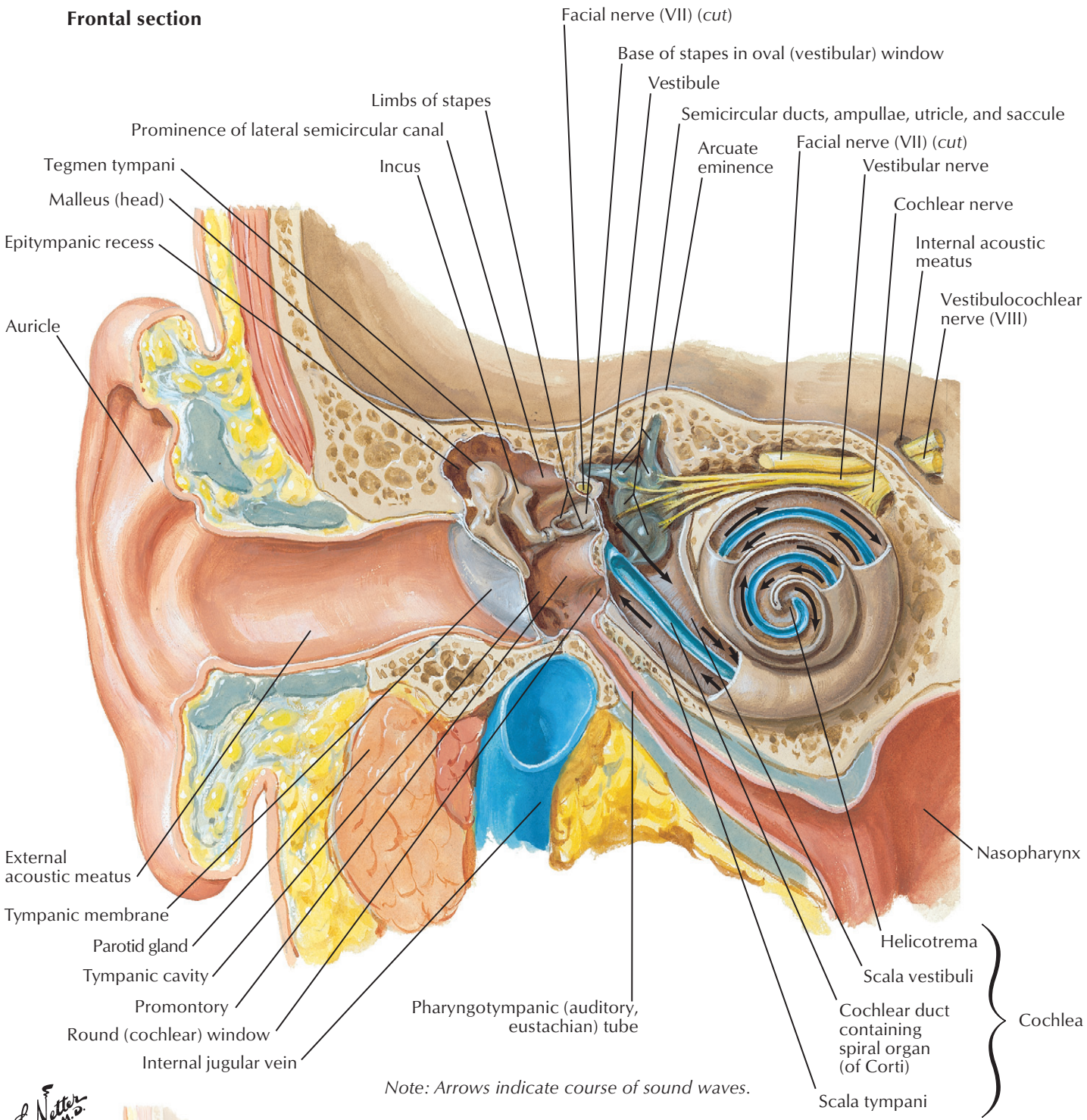
Vascular arrangements within the choroid (vascular tunic) of the eyeball

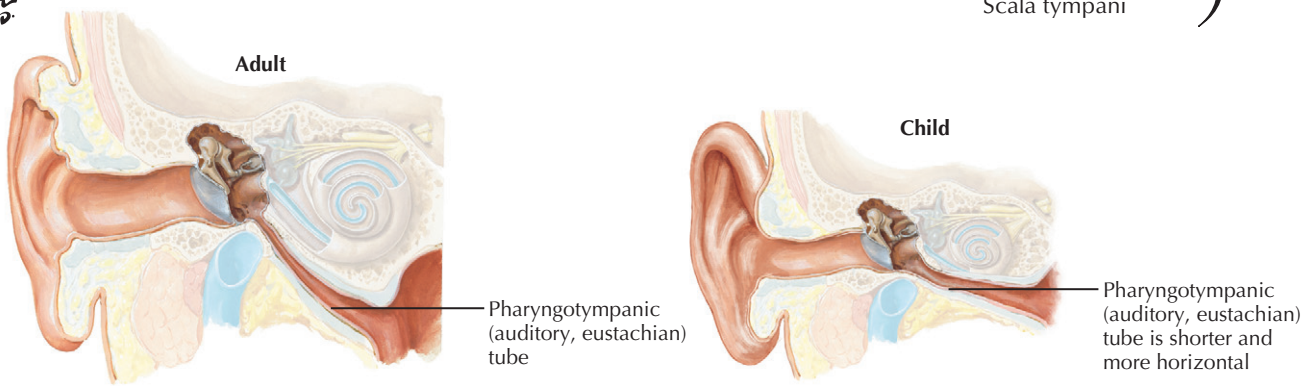


*The episcleral veins are shown here anastomosing with the vorticose veins, which they do; however, they also drain into the anterior ciliary veins.

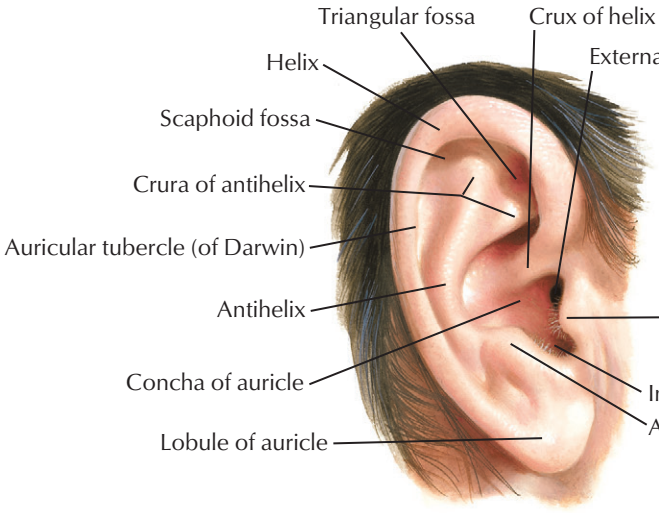
C. Machado M.D.

Pathway of Sound Reception

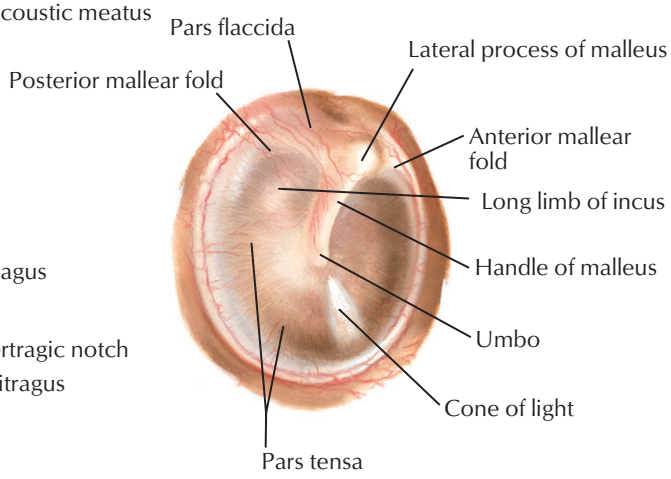




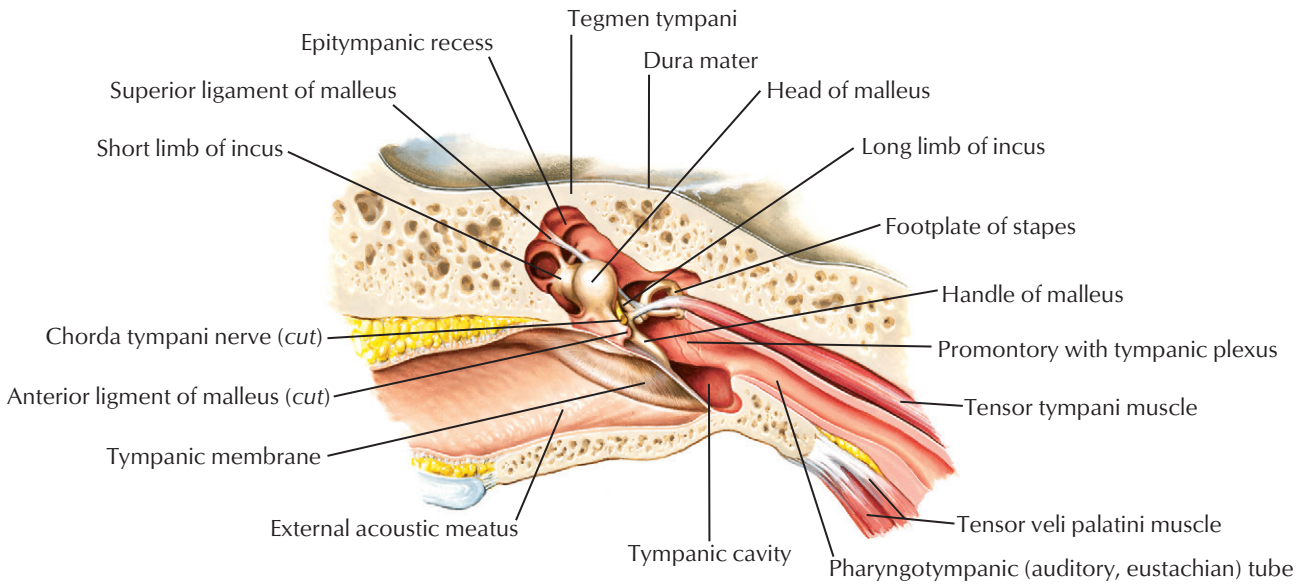
Right auricle (pinna)



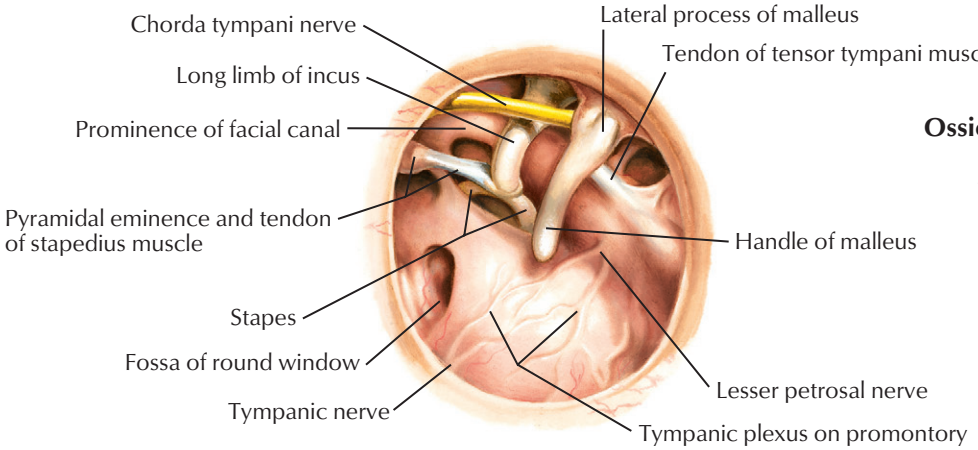
Otoscopic view of right tympanic membrane



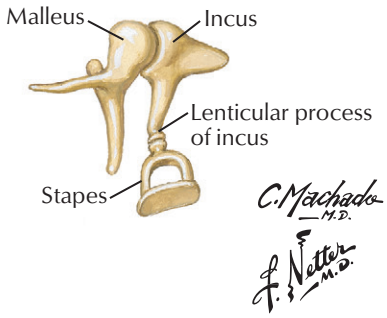
Coronal oblique section of external acoustic meatus and middle ear (tympanic cavity)



Right tympanic cavity after removal of tympanic membrane (lateral view)

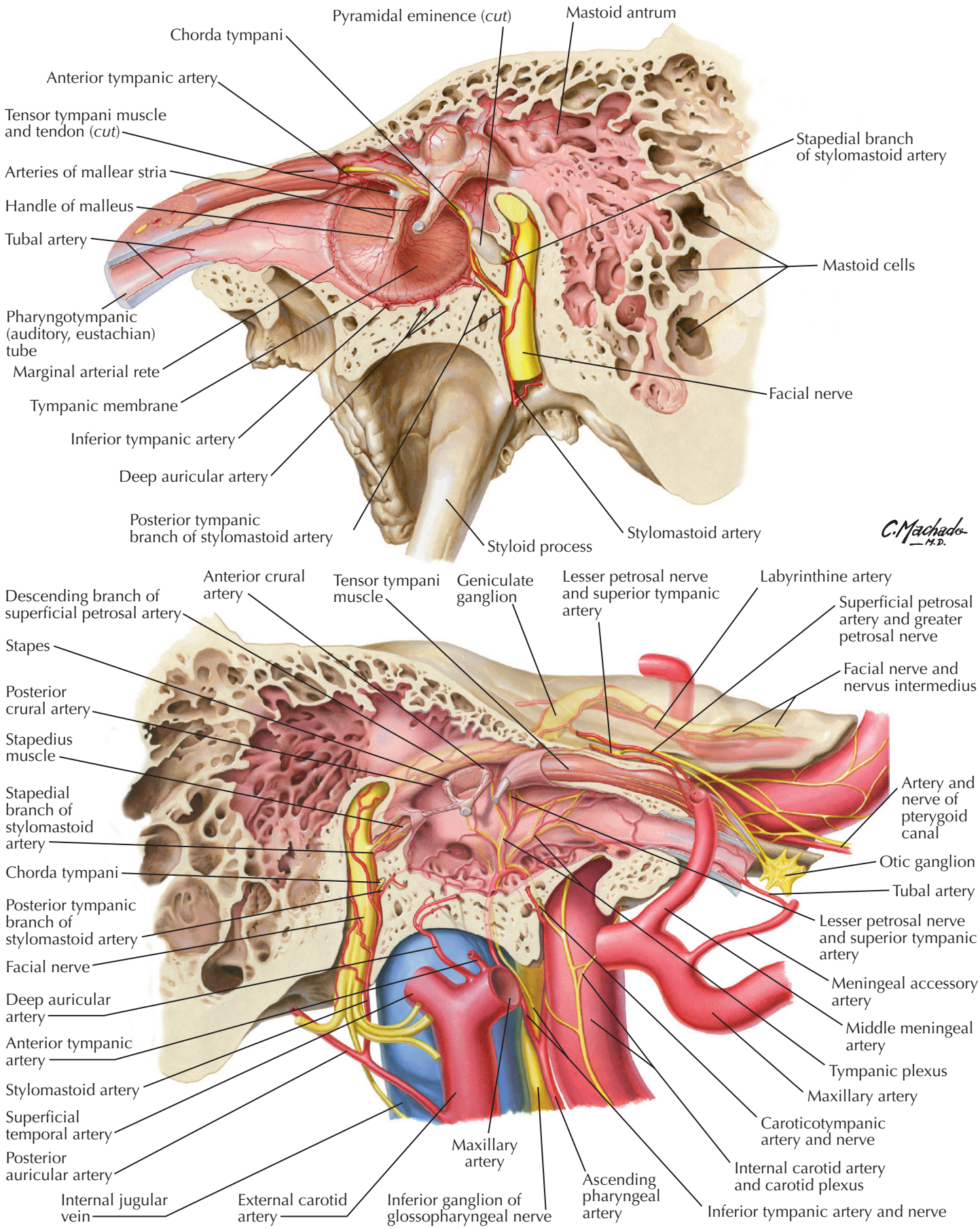


Ossicles articulated: medial view

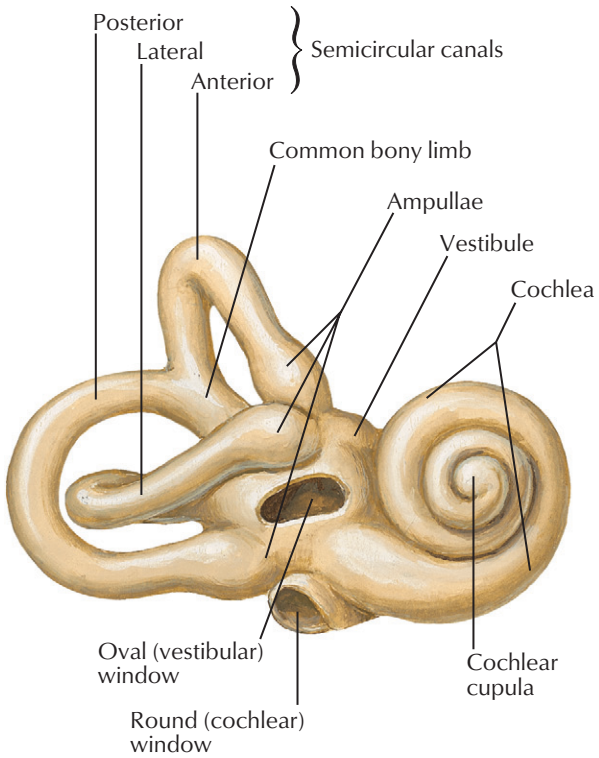


Tympanic Cavity

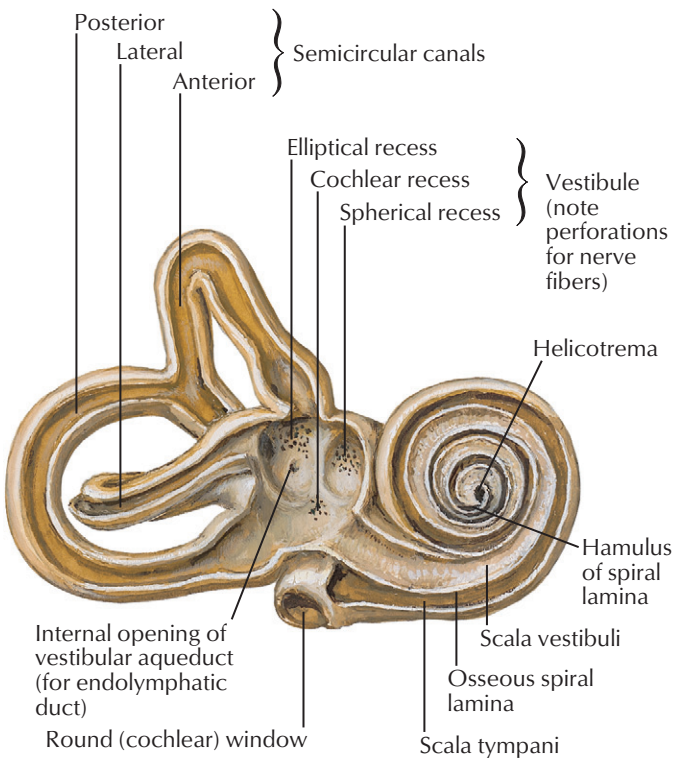
See also Plates 50, 124, 136



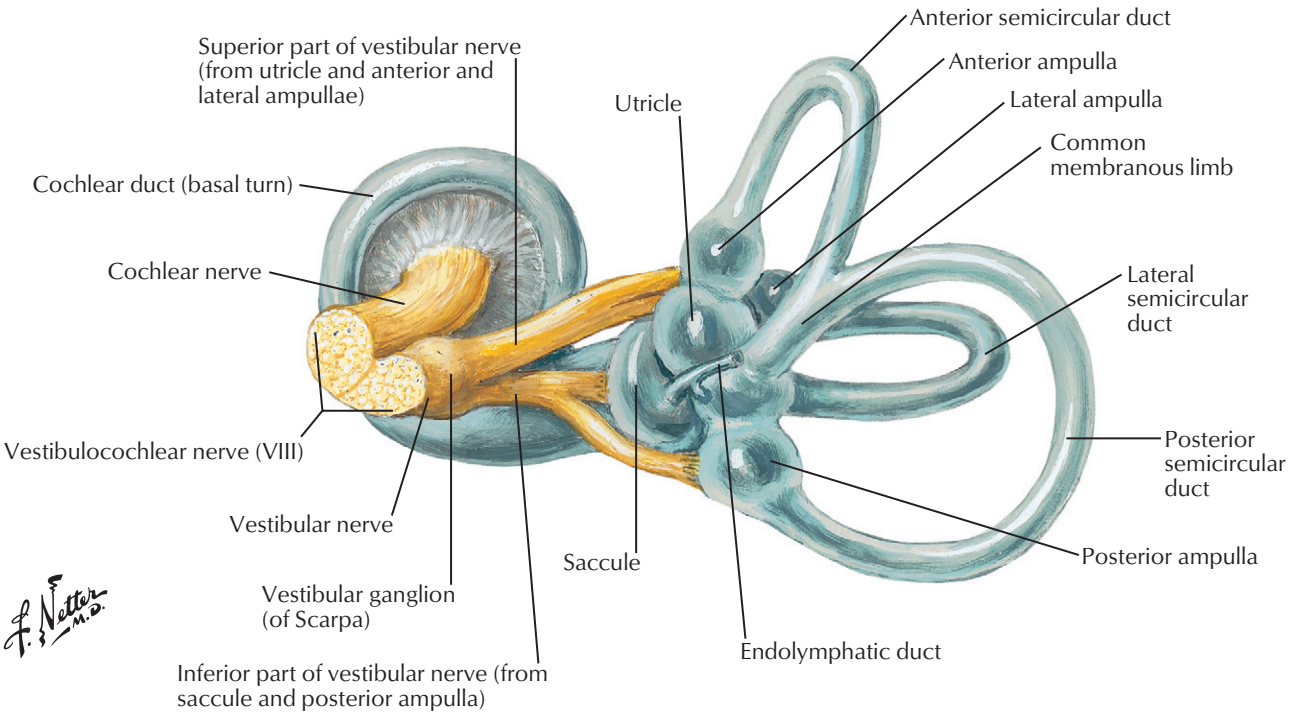
Right bony labyrinth (otic capsule), anterolateral view: surrounding cancellous bone removed



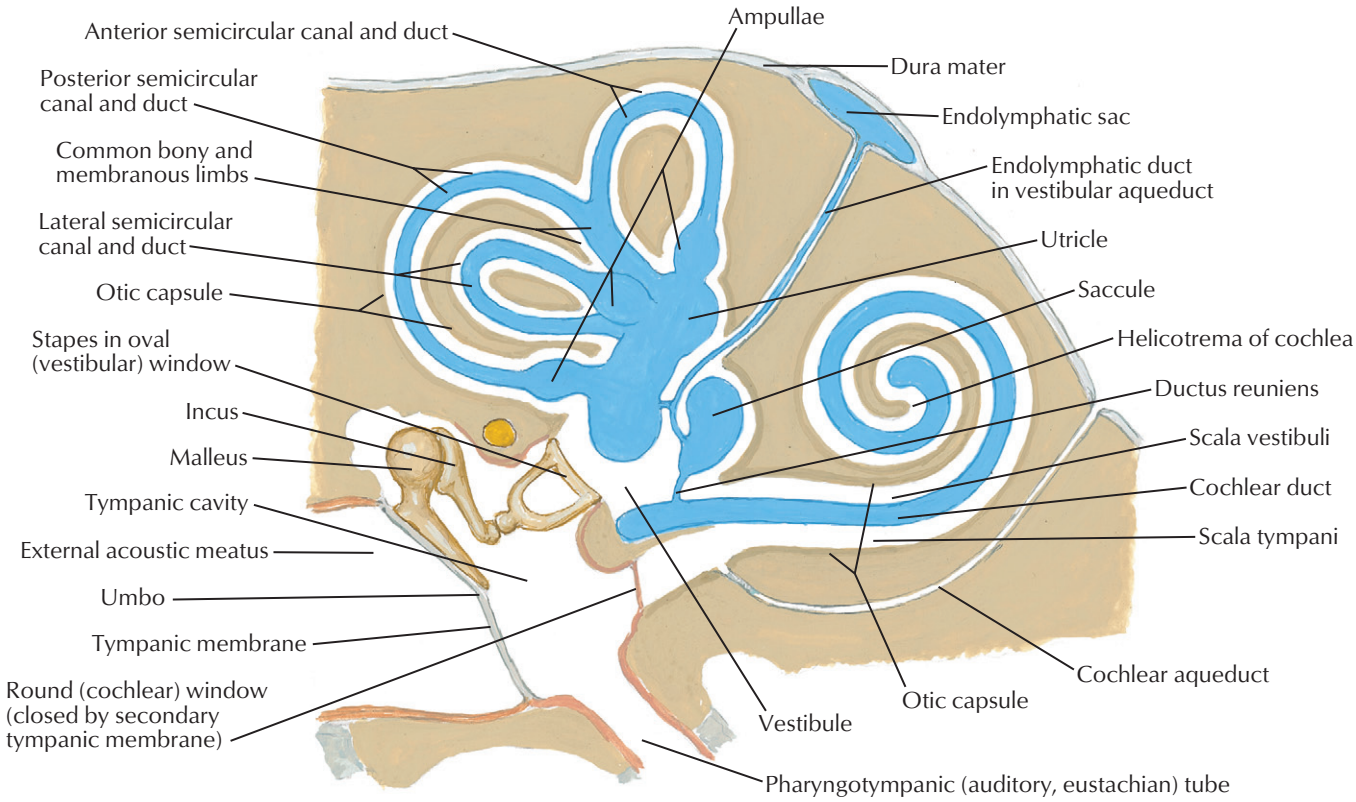
Dissected right bony labyrinth (otic capsule): membranous labyrinth removed



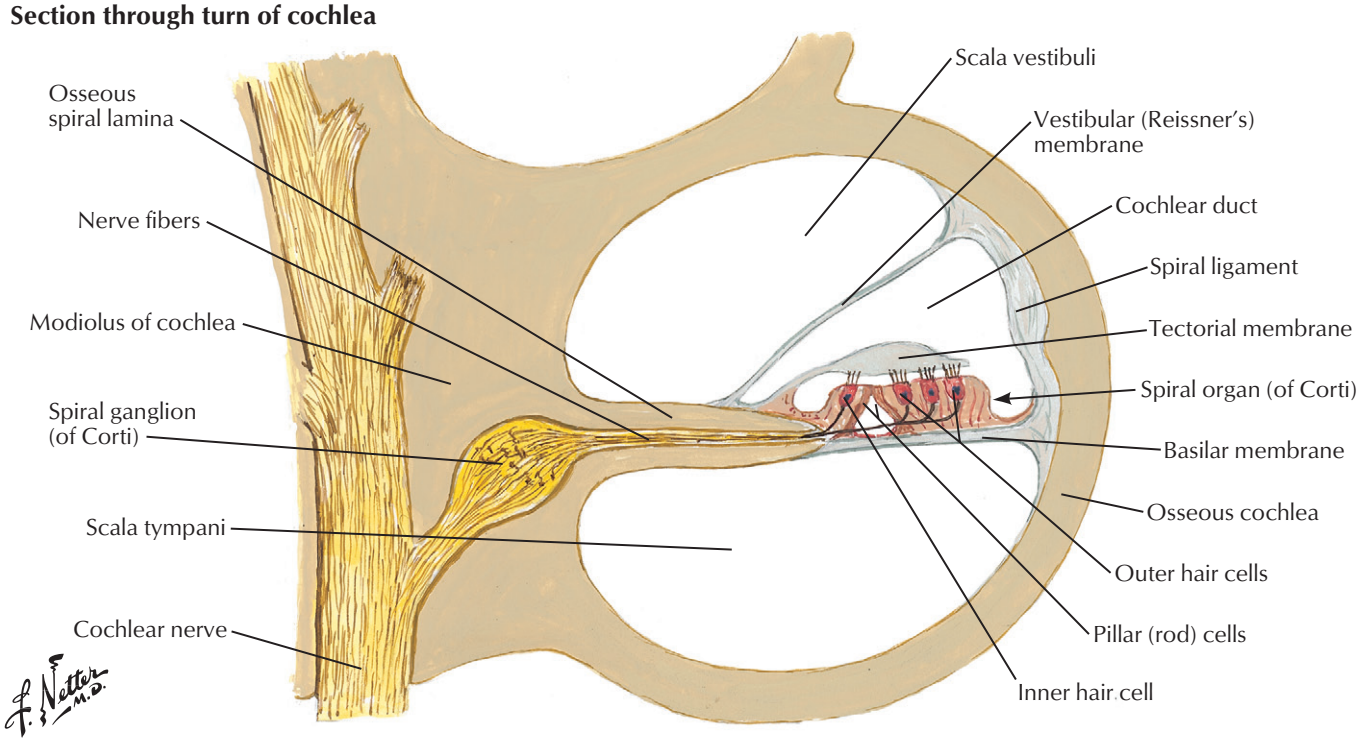
Right membranous labyrinth with nerves: medial view



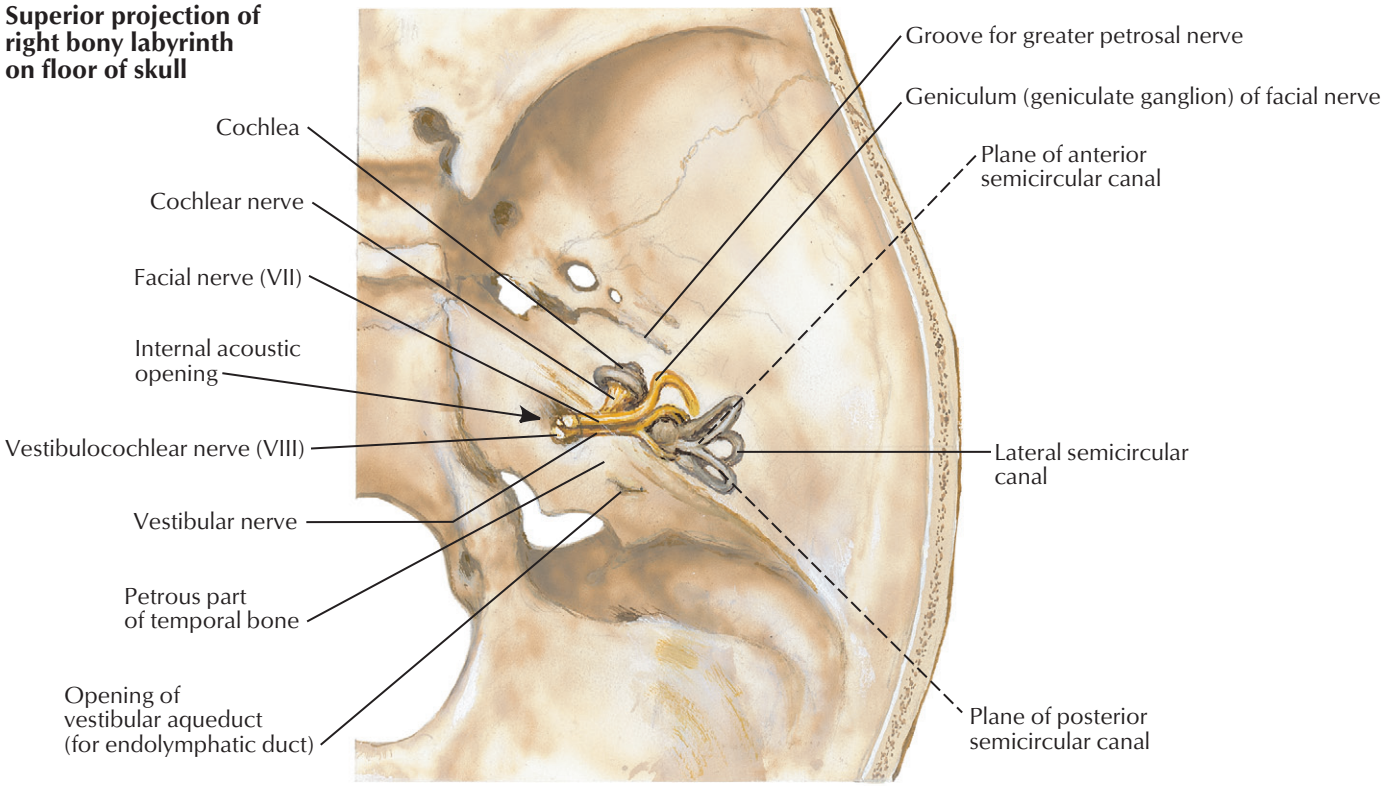
Bony and membranous labyrinths: schema



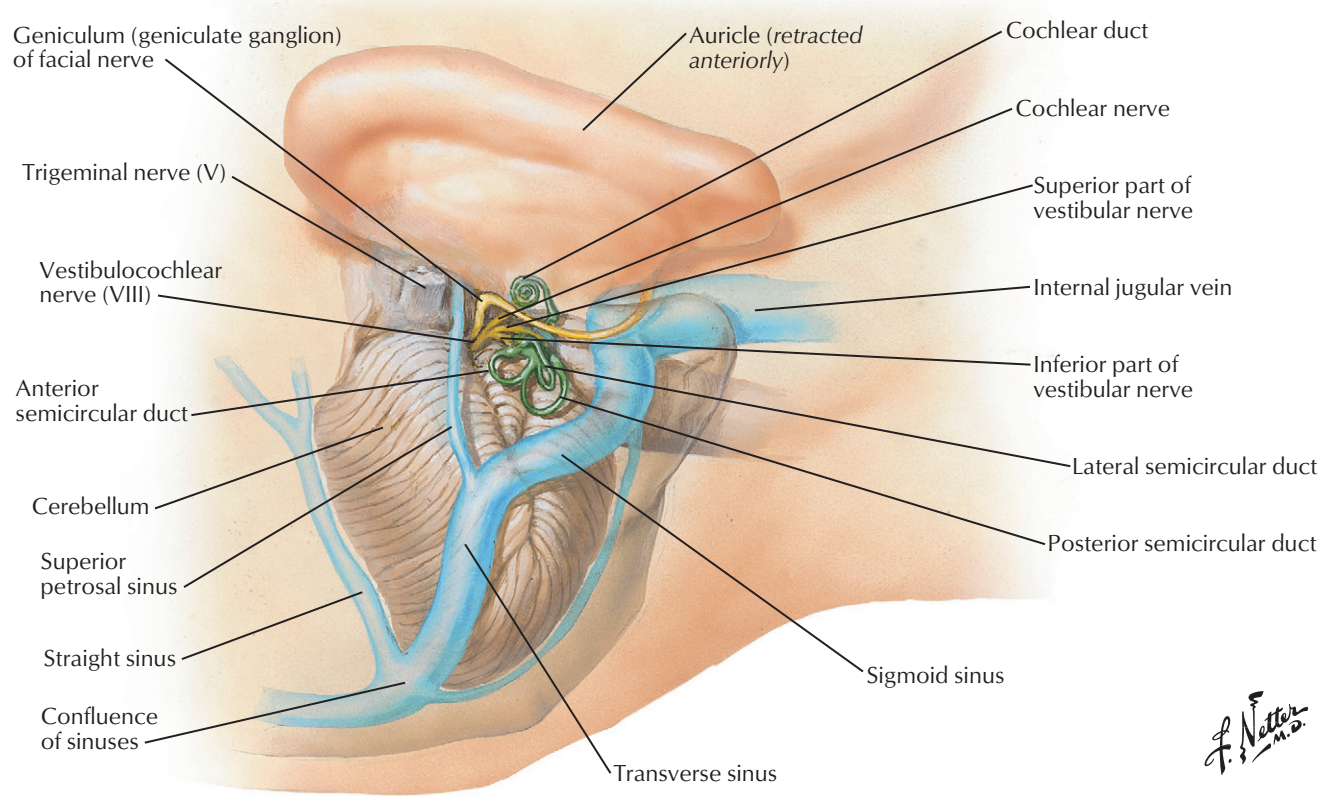
Section through turn of cochlea



Superior projection of right bony labyrinth on floor of skull



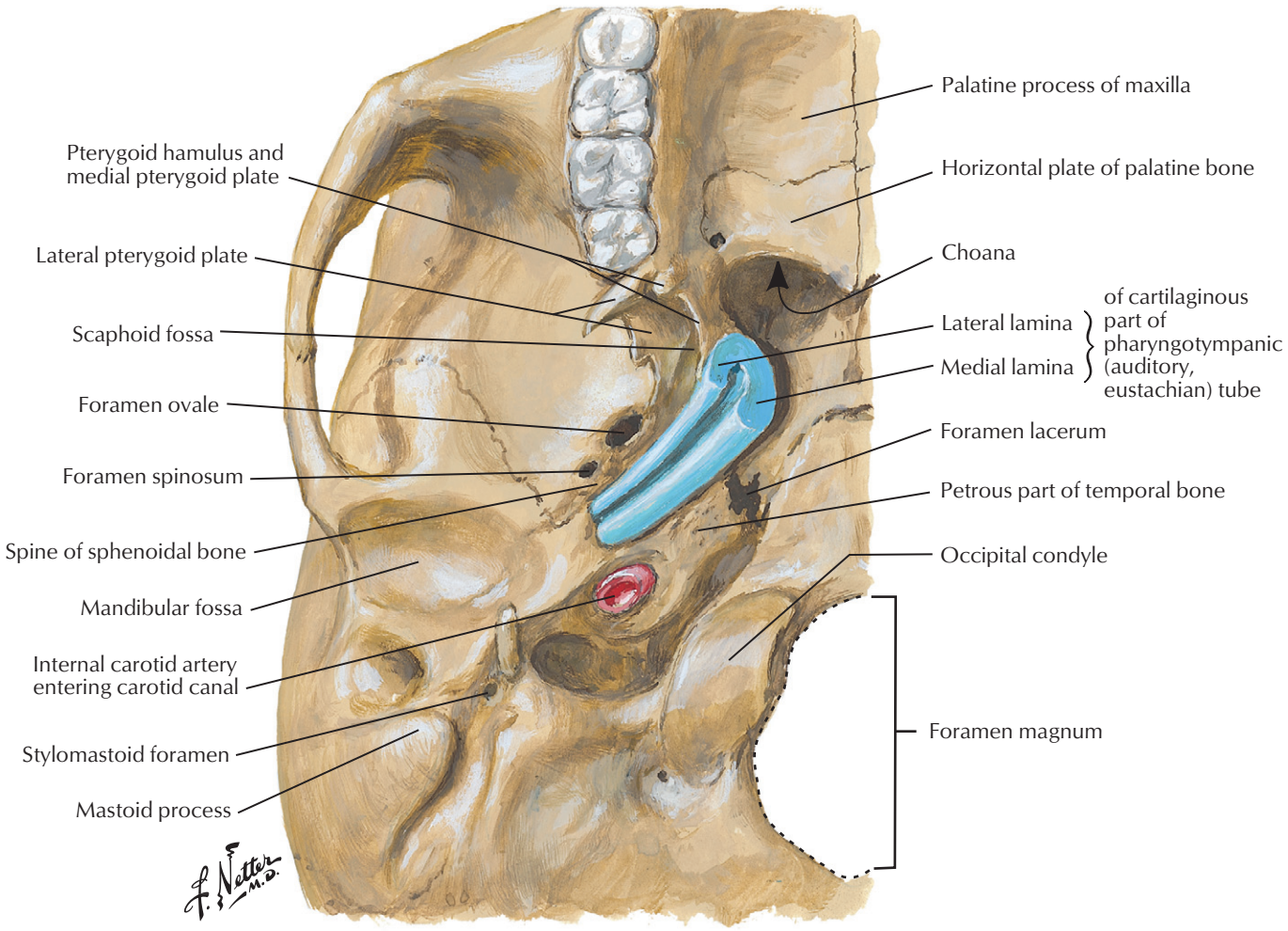
Lateral projection of right membranous labyrinth



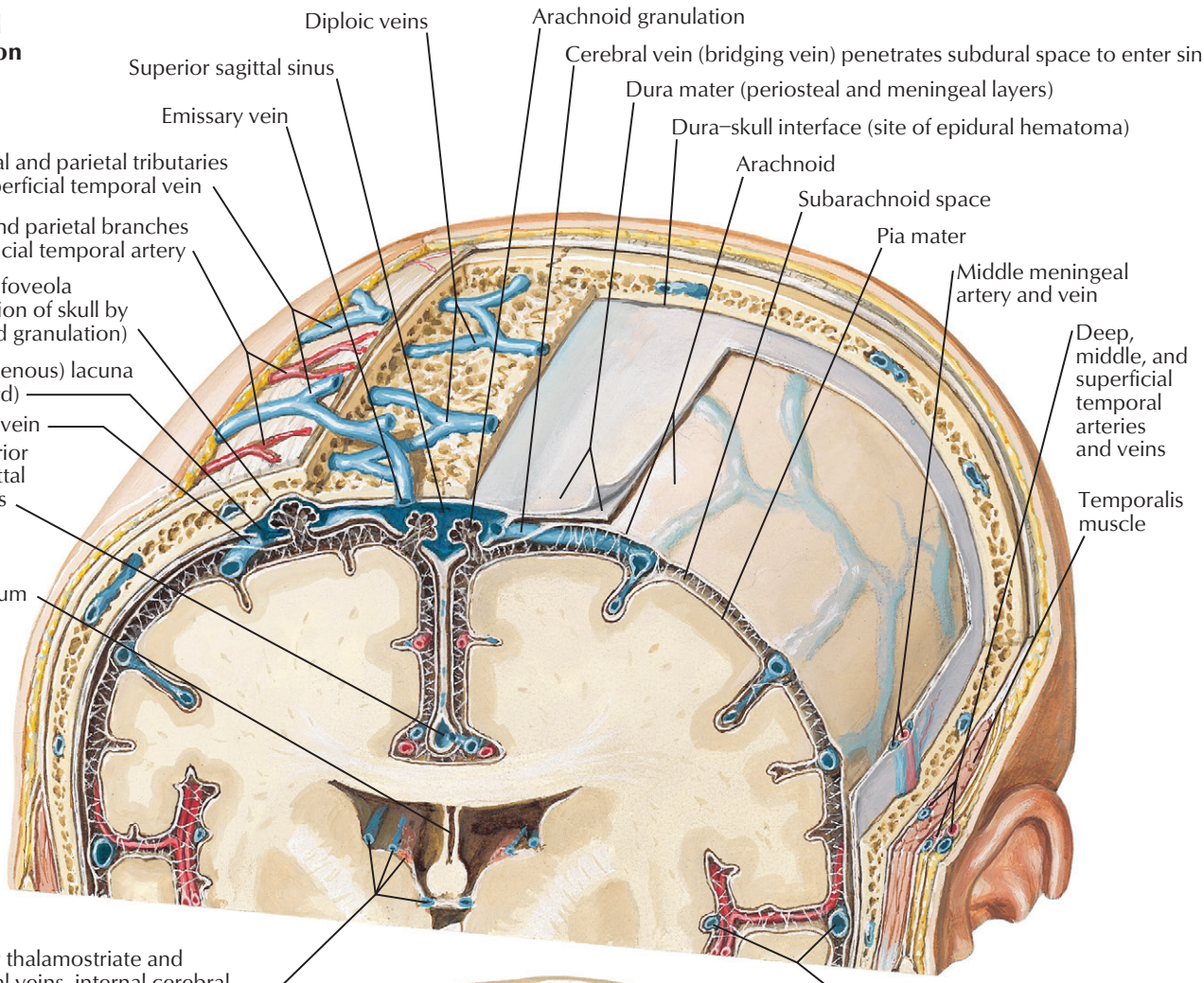
Pharyngotympanic (Auditory, Eustachian) Tube

See also **Plate 49**

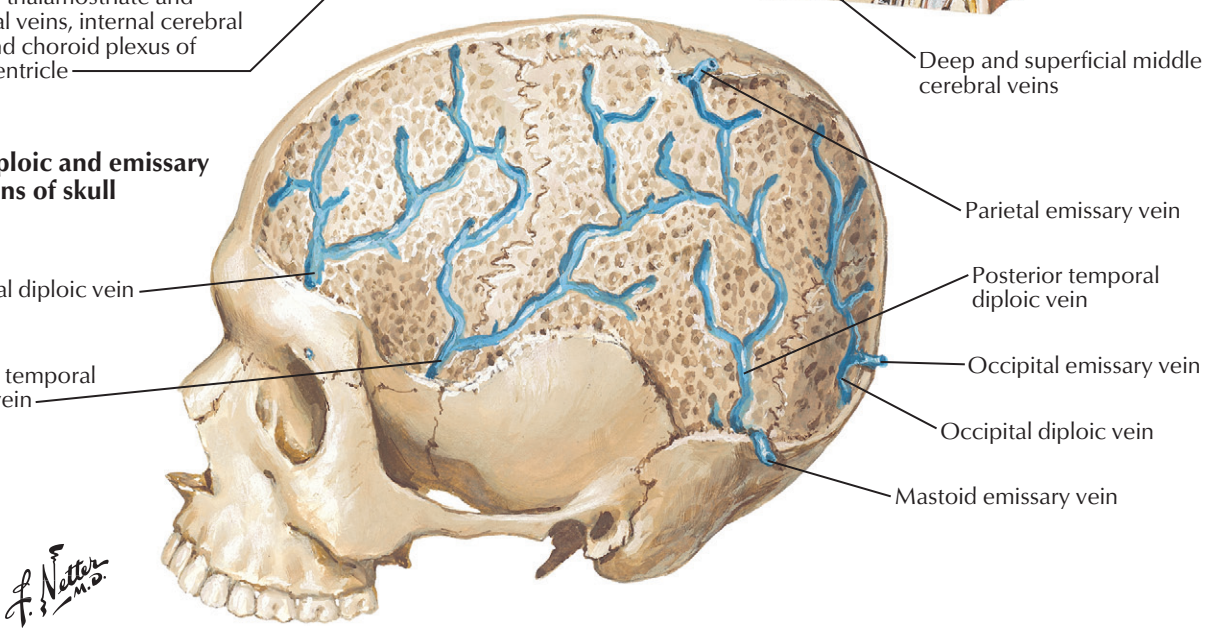
Cartilaginous part of pharyngotympanic (auditory, eustachian) tube at base of skull: inferior view



Coronal dissection

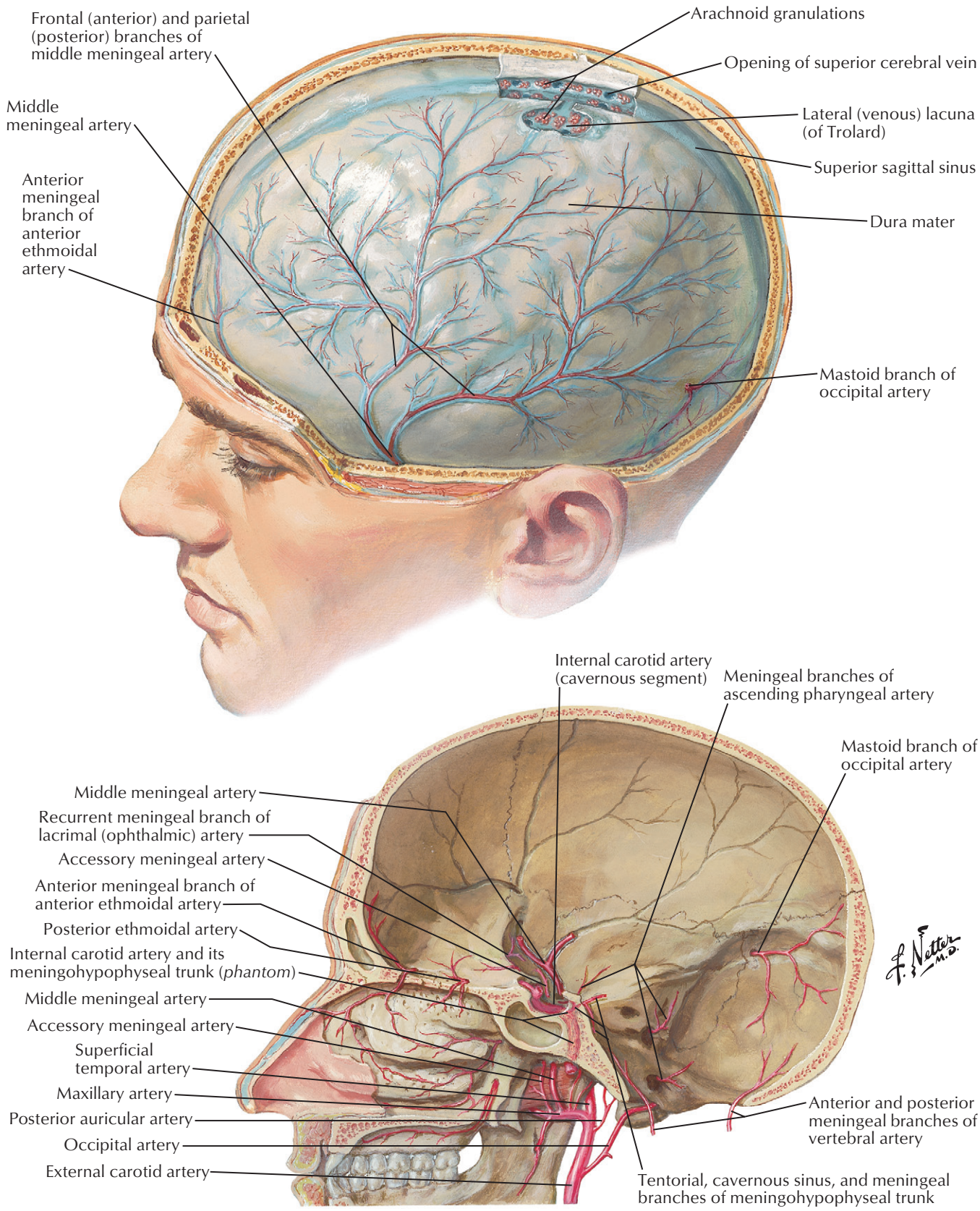


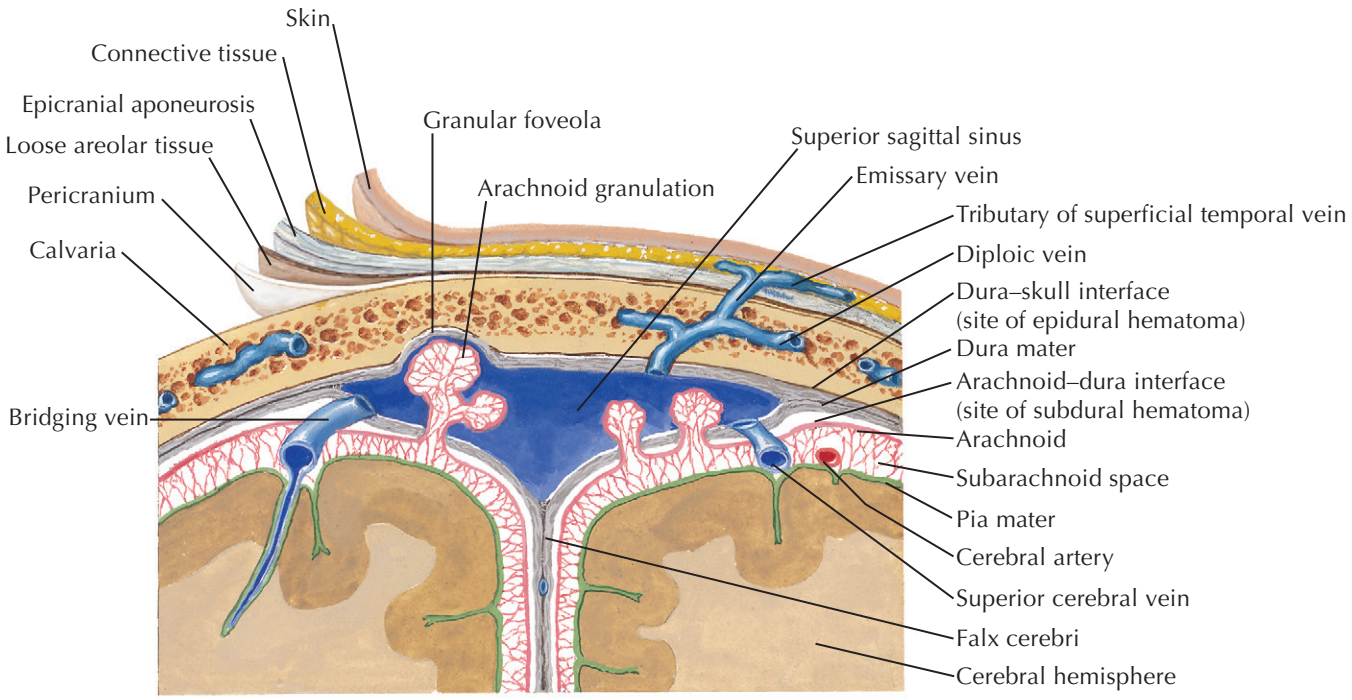
Diploic and emissary veins of skull

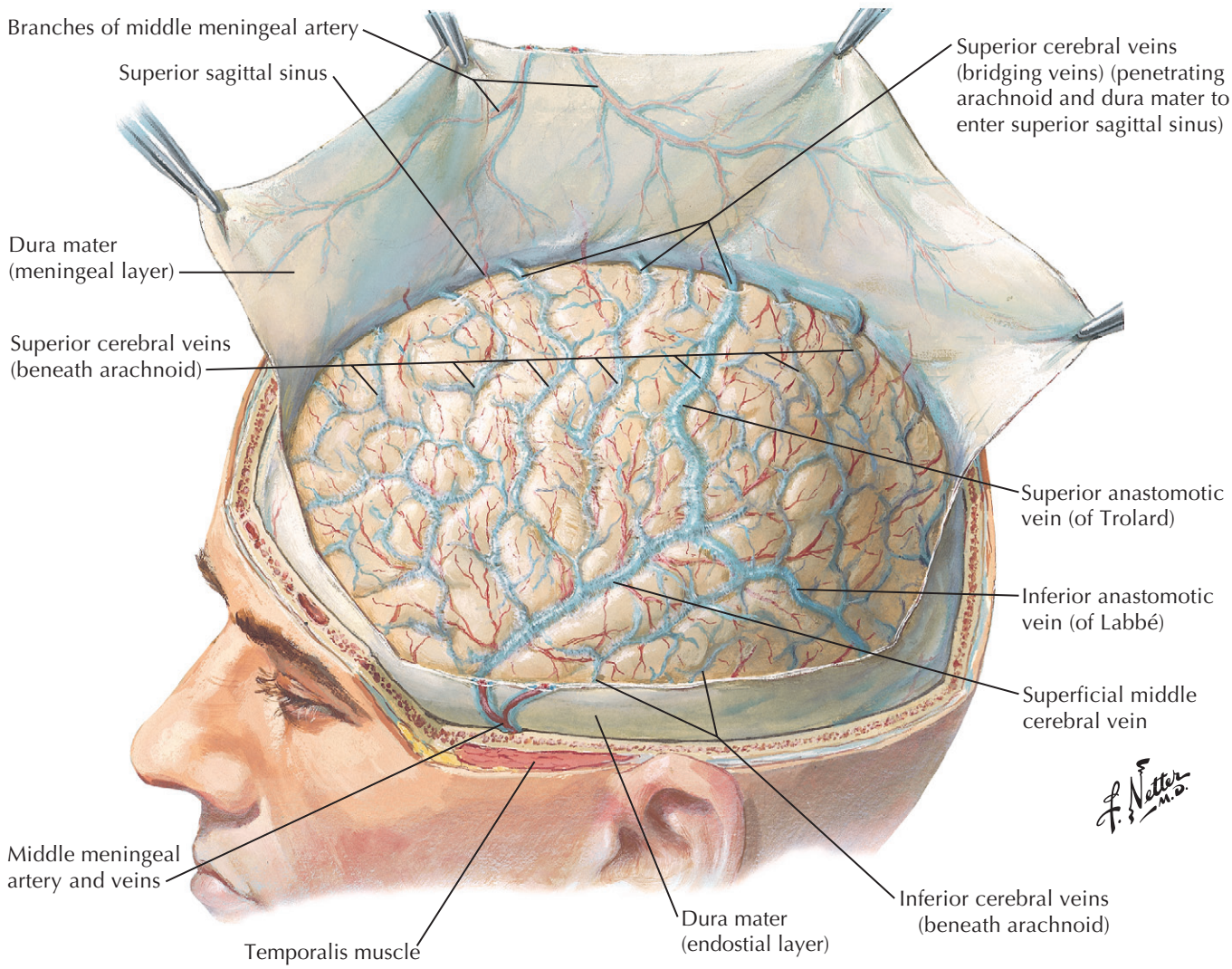


Meningeal Arteries

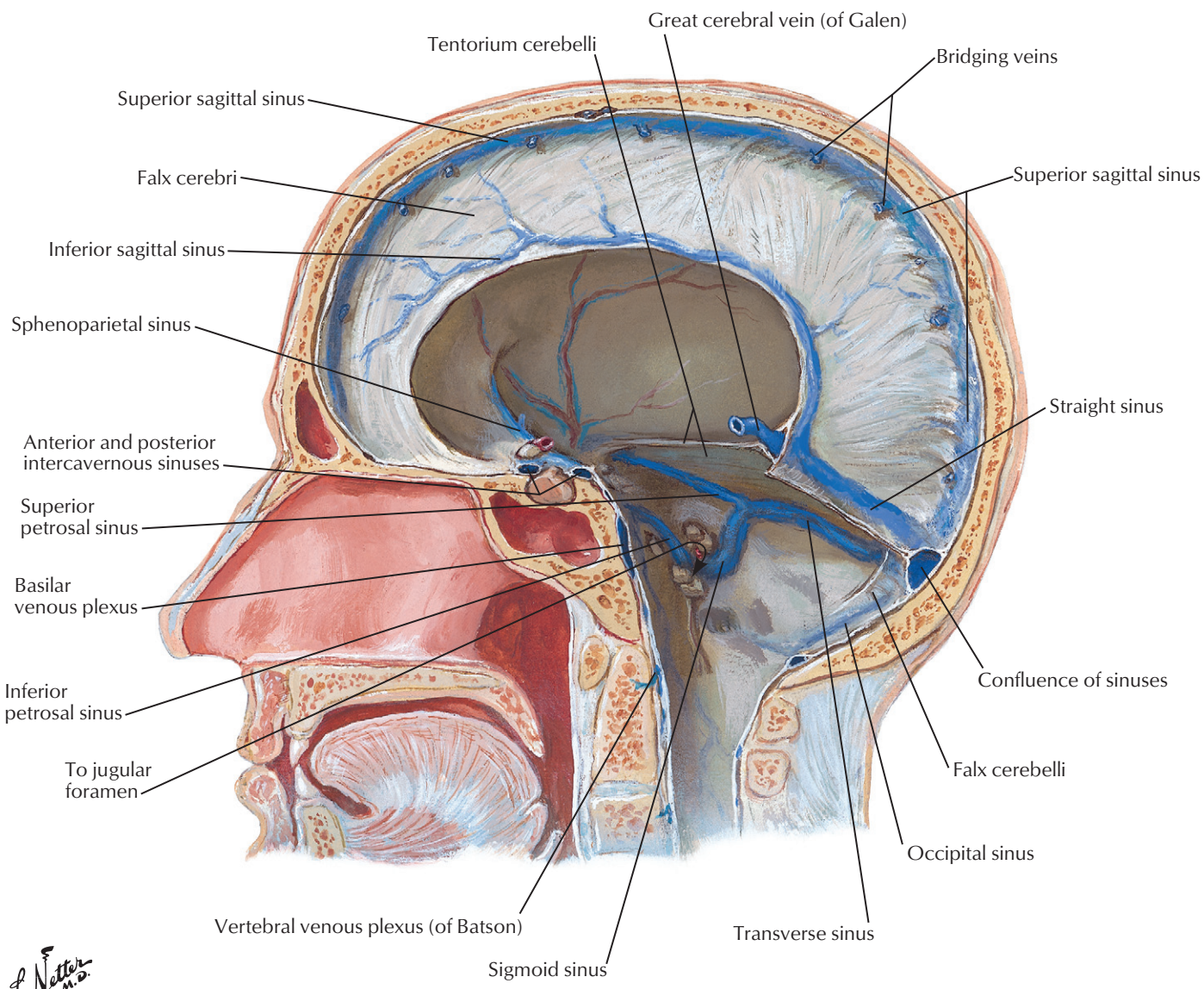
See also Plates 9, 51, 137



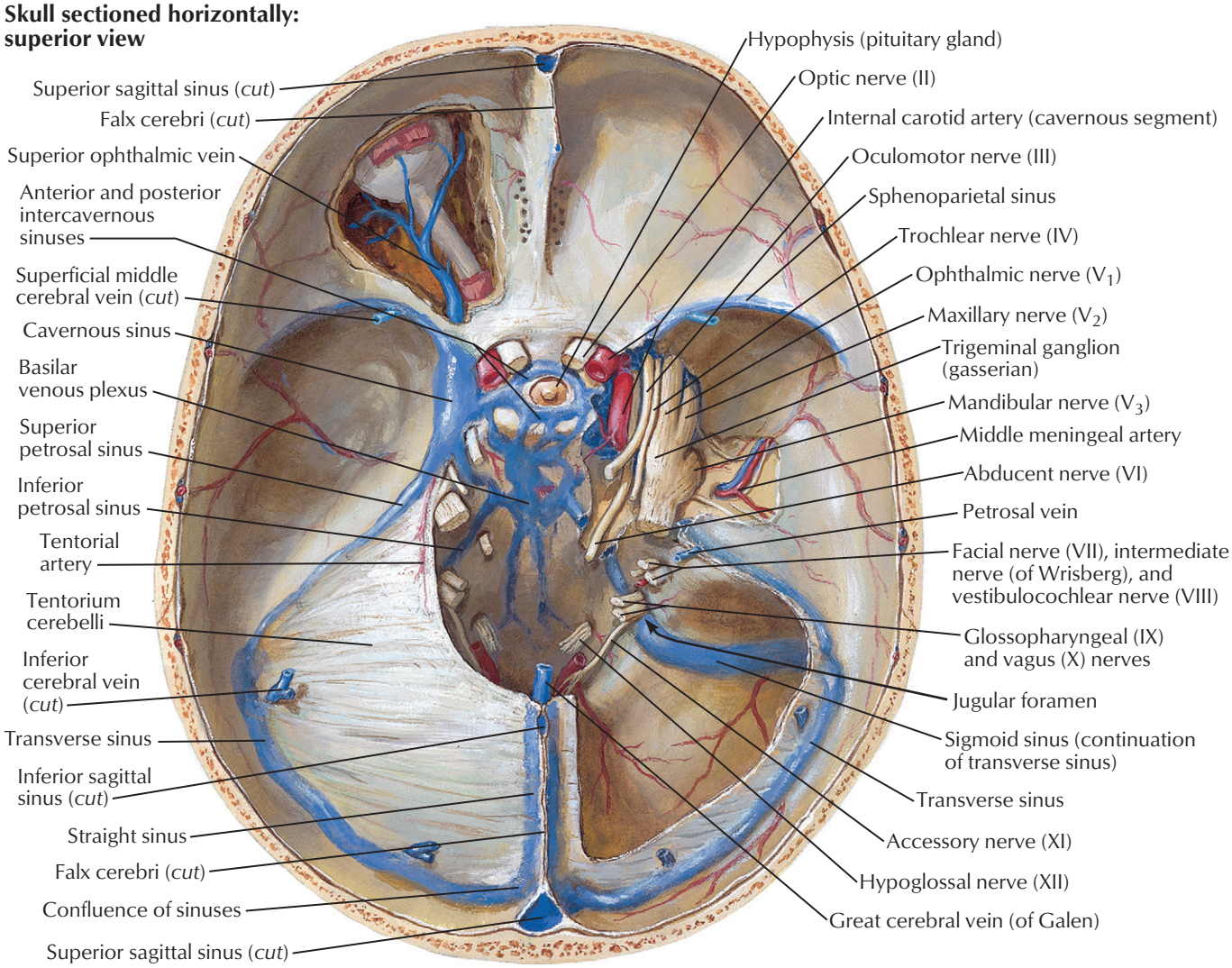

Skin
Connective tissue
Epicranial aponeurosis
Loose areolar tissue
Pericranium
Calvaria
Granular foveola
Arachnoid granulation
Superior sagittal sinus
Emissary vein
Tributary of superficial temporal vein
Diploic vein
Dura–skull interface
(site of epidural hematoma)
Dura mater
Arachnoid–dura interface
(site of subdural hematoma)
Arachnoid
Subarachnoid space
Pia mater
Cerebral artery
Superior cerebral vein
Falx cerebri
Cerebral hemisphere
Bridging vein

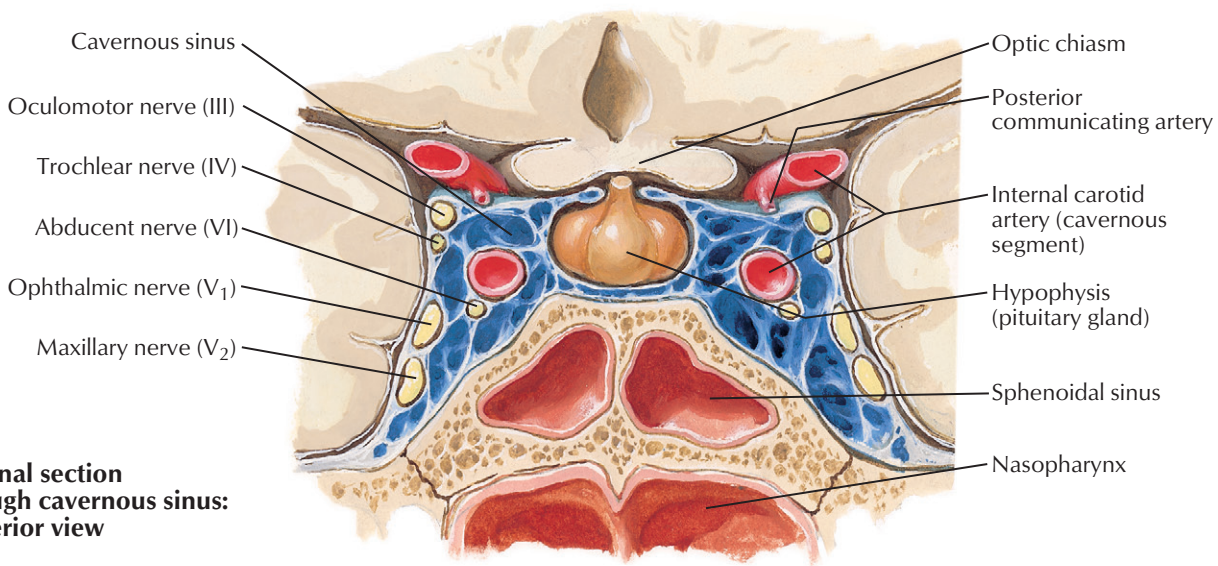

Branches of middle meningeal artery
Superior sagittal sinus
Superior cerebral veins
(bridging veins) (penetrating
arachnoid and dura mater to
enter superior sagittal sinus)
Dura mater
(meningeal layer)
Superior cerebral veins
(beneath arachnoid)
Superior anastomotic
vein (of Trolard)
Inferior anastomotic
vein (of Labbé)
Superficial middle
cerebral vein
Middle meningeal
artery and veins
Temporalis muscle
Dura mater
(endostial layer)
Inferior cerebral veins
(beneath arachnoid)

Sagittal section

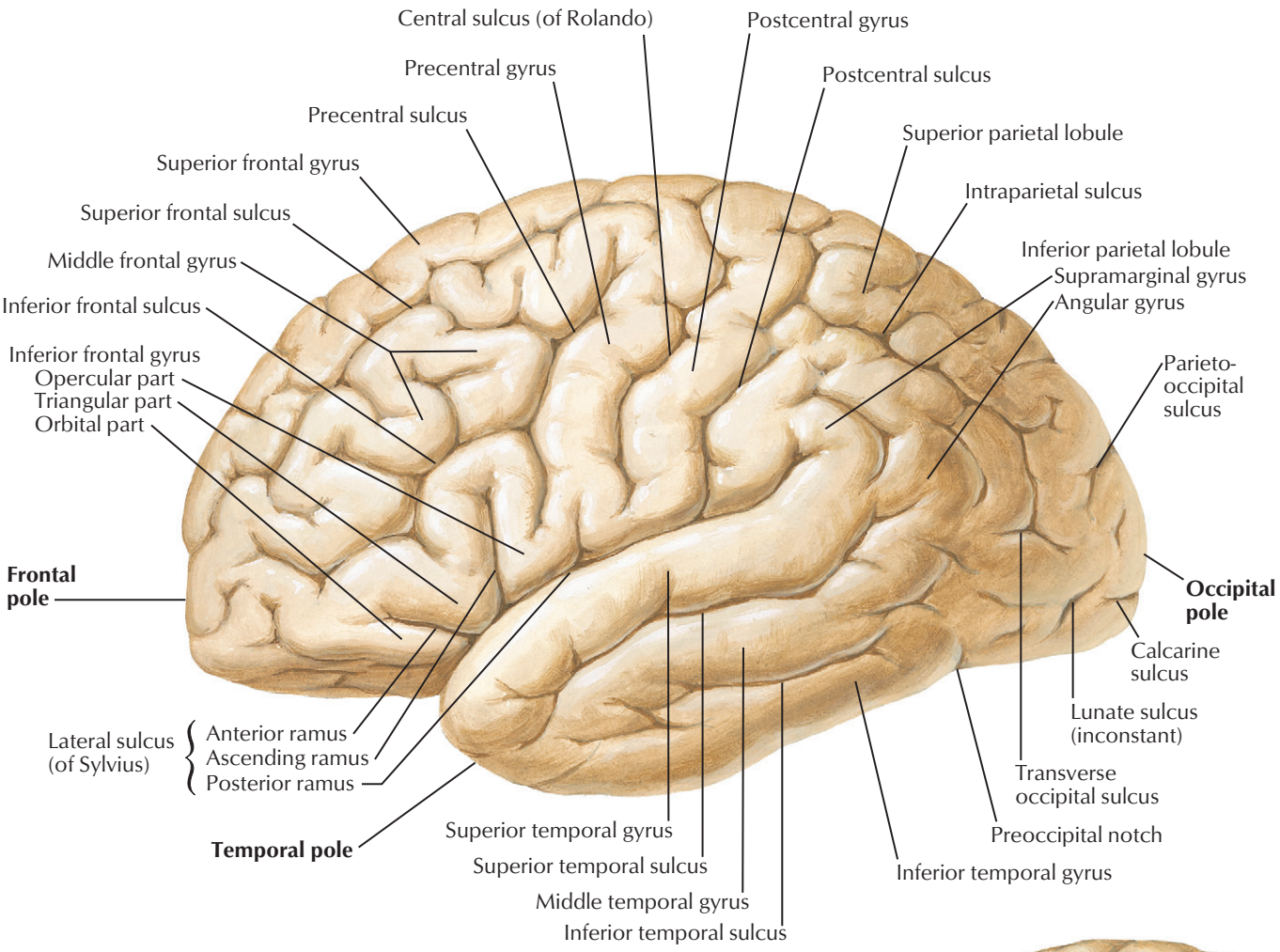


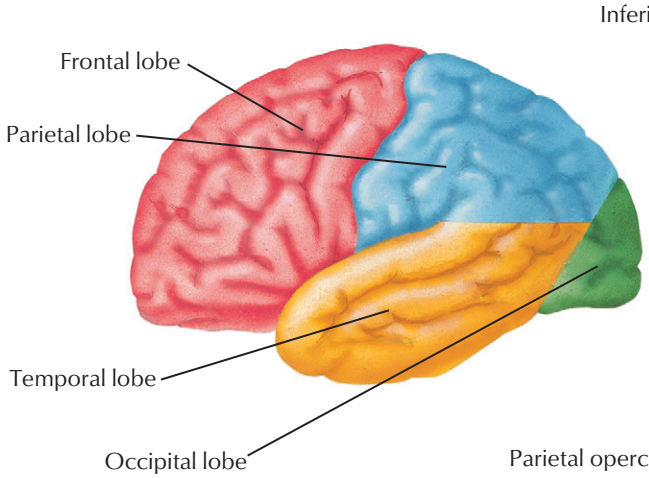
Skull sectioned horizontally: superior view

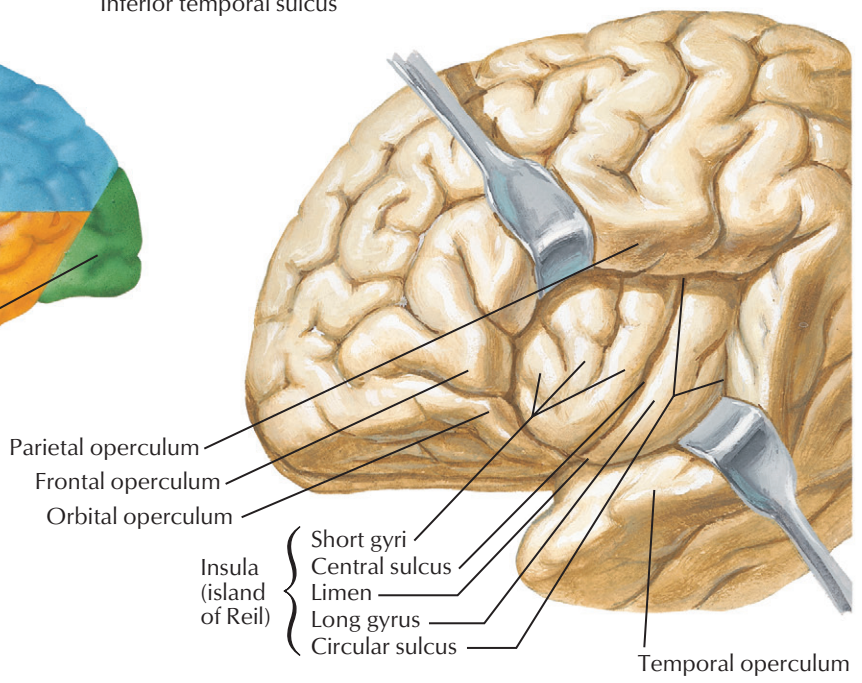




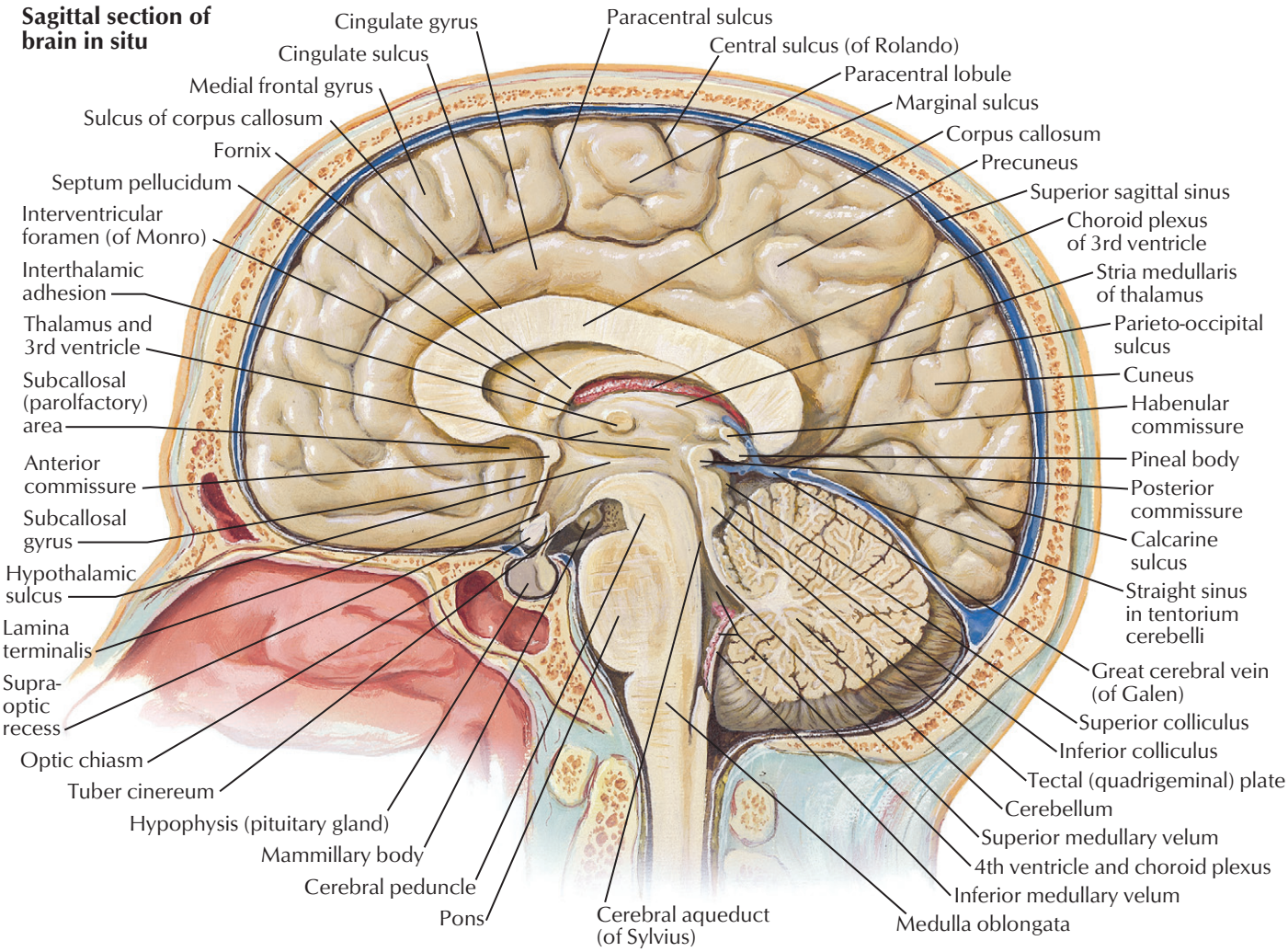
Coronal section through cavernous sinus: posterior view


Central sulcus (of Rolando)
Postcentral gyrus
Precentral gyrus
Postcentral sulcus
Precentral sulcus
Superior parietal lobule
Superior frontal gyrus
Intraparietal sulcus
Superior frontal sulcus
Inferior parietal lobule
Middle frontal gyrus
Supramarginal gyrus
Inferior frontal sulcus
Angular gyrus
Inferior frontal gyrus
Opercular part
Triangular part
Orbital part
Parieto-occipital sulcus
Frontal pole
Occipital pole
Calcarine sulcus
Lateral sulcus (of Sylvius)
Anterior ramus
Ascending ramus
Posterior ramus
Lunate sulcus (inconstant)
Transverse occipital sulcus
Temporal pole
Superior temporal gyrus
Preoccipital notch
Superior temporal sulcus
Inferior temporal gyrus
Middle temporal gyrus
Inferior temporal sulcus

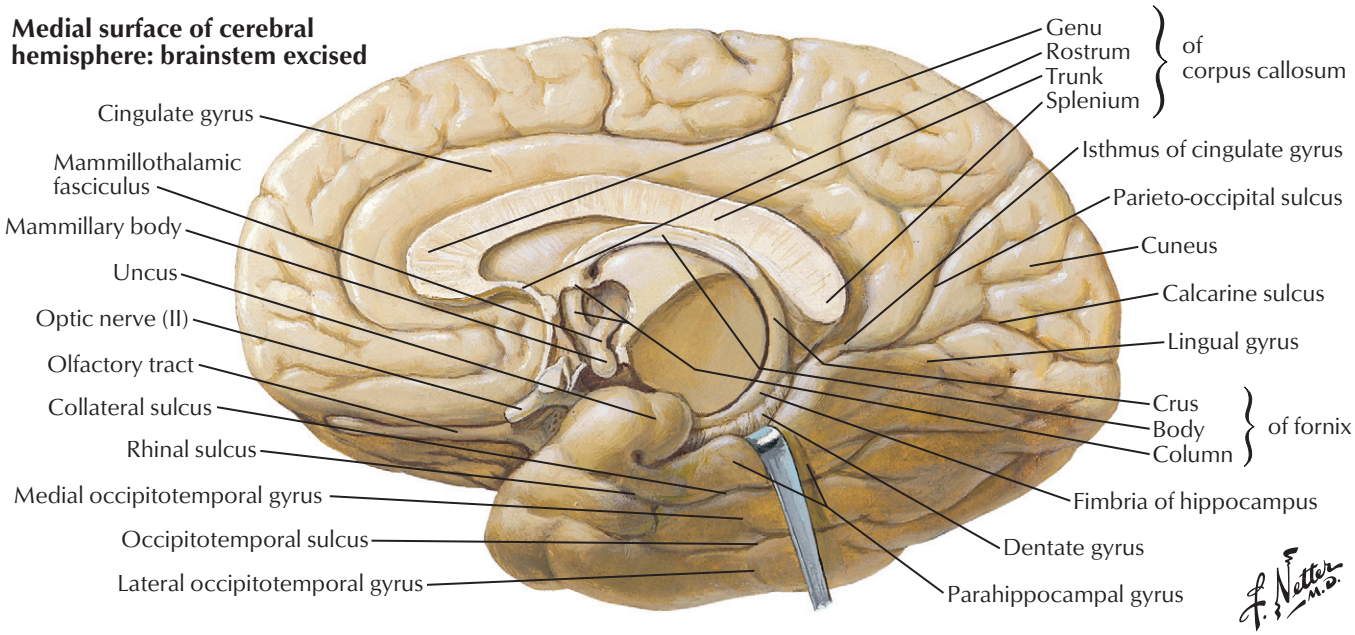

Frontal lobe
Parietal lobe
Temporal lobe
Occipital lobe


Parietal operculum
Frontal operculum
Orbital operculum
Insula (island of Reil)
Short gyri
Central sulcus
Limen
Long gyrus
Circular sulcus
Temporal operculum

Sagittal section of brain in situ

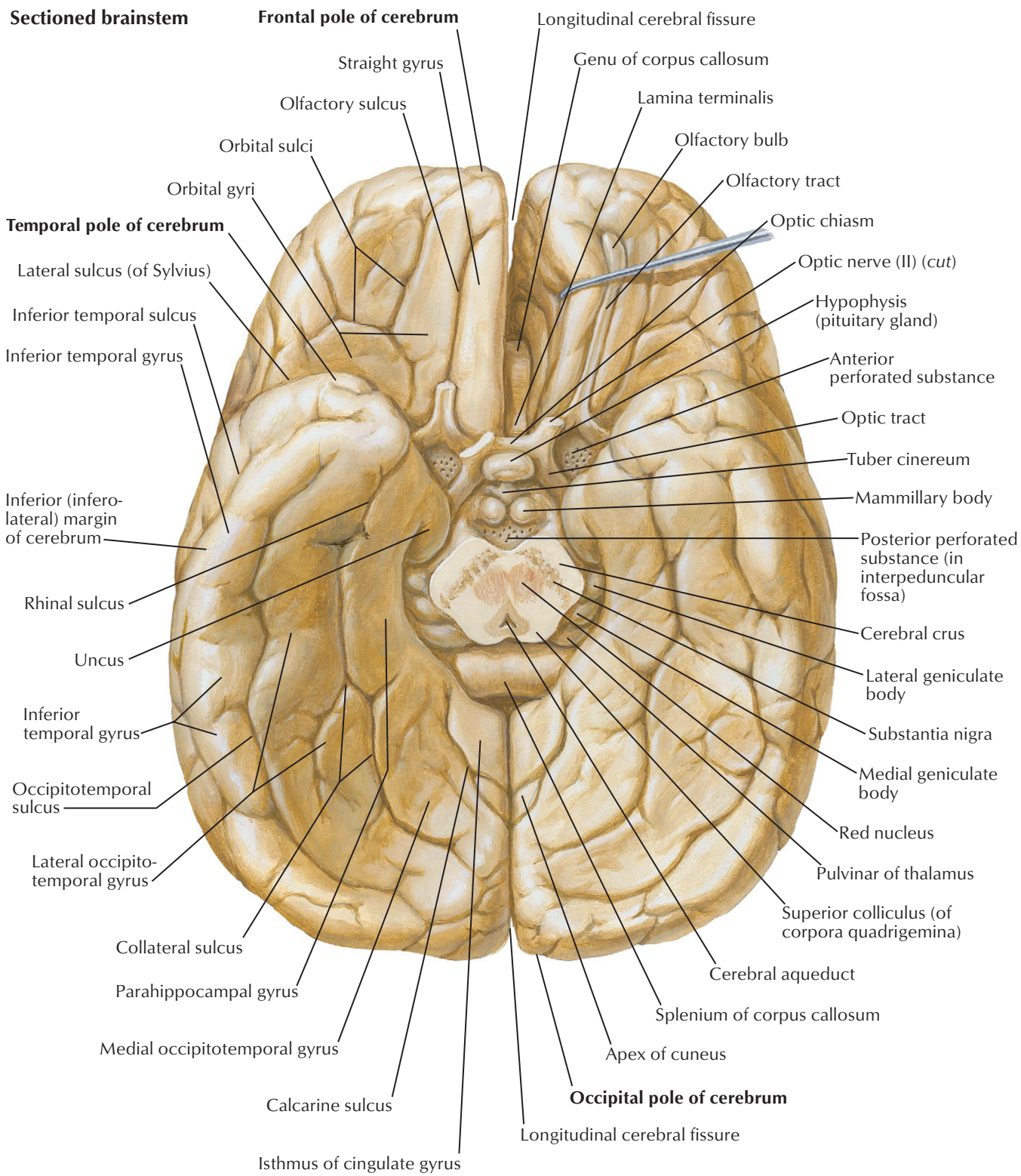


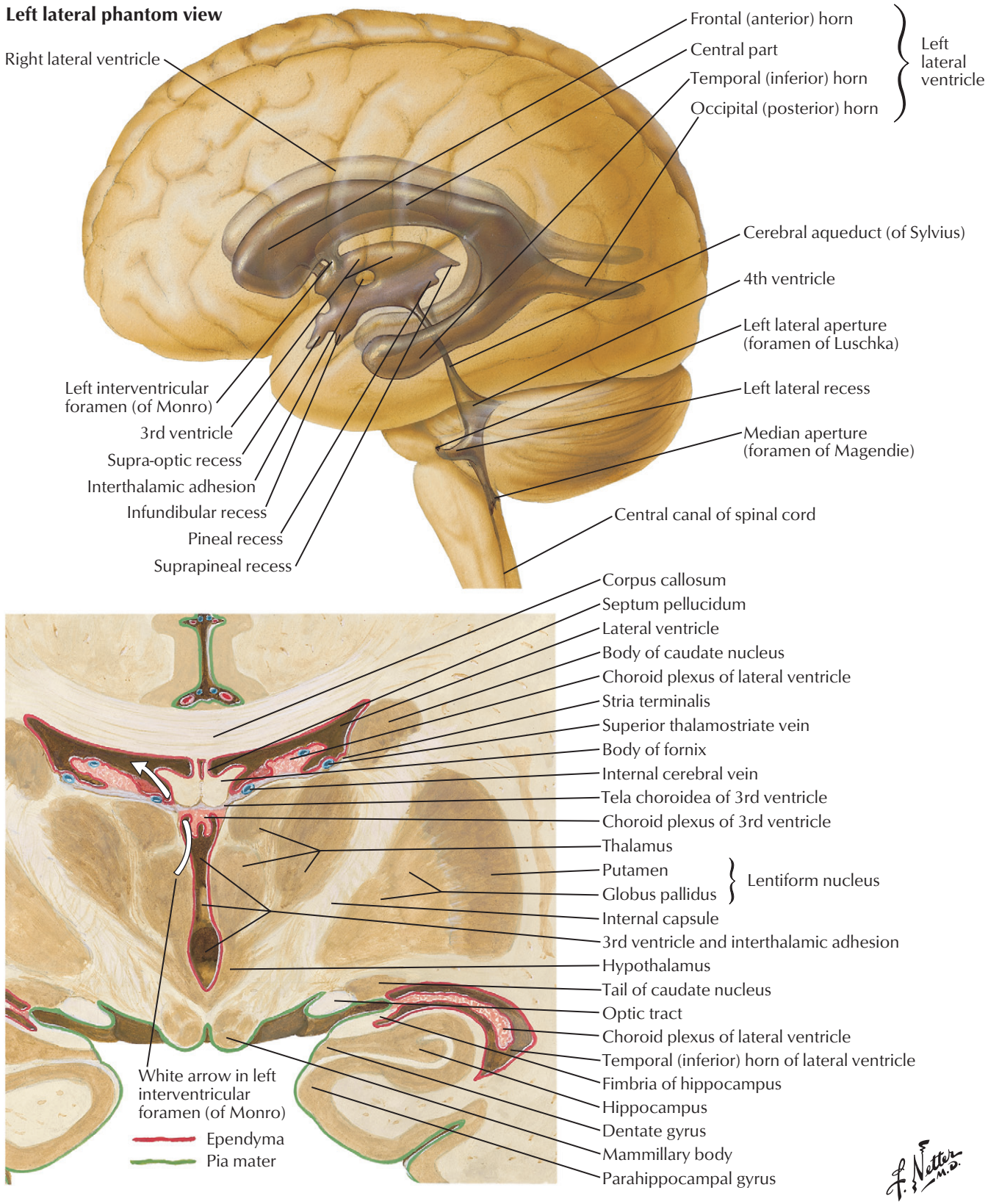
Medial surface of cerebral hemisphere: brainstem excised



Cerebrum: Inferior View

See also **Plate 148**

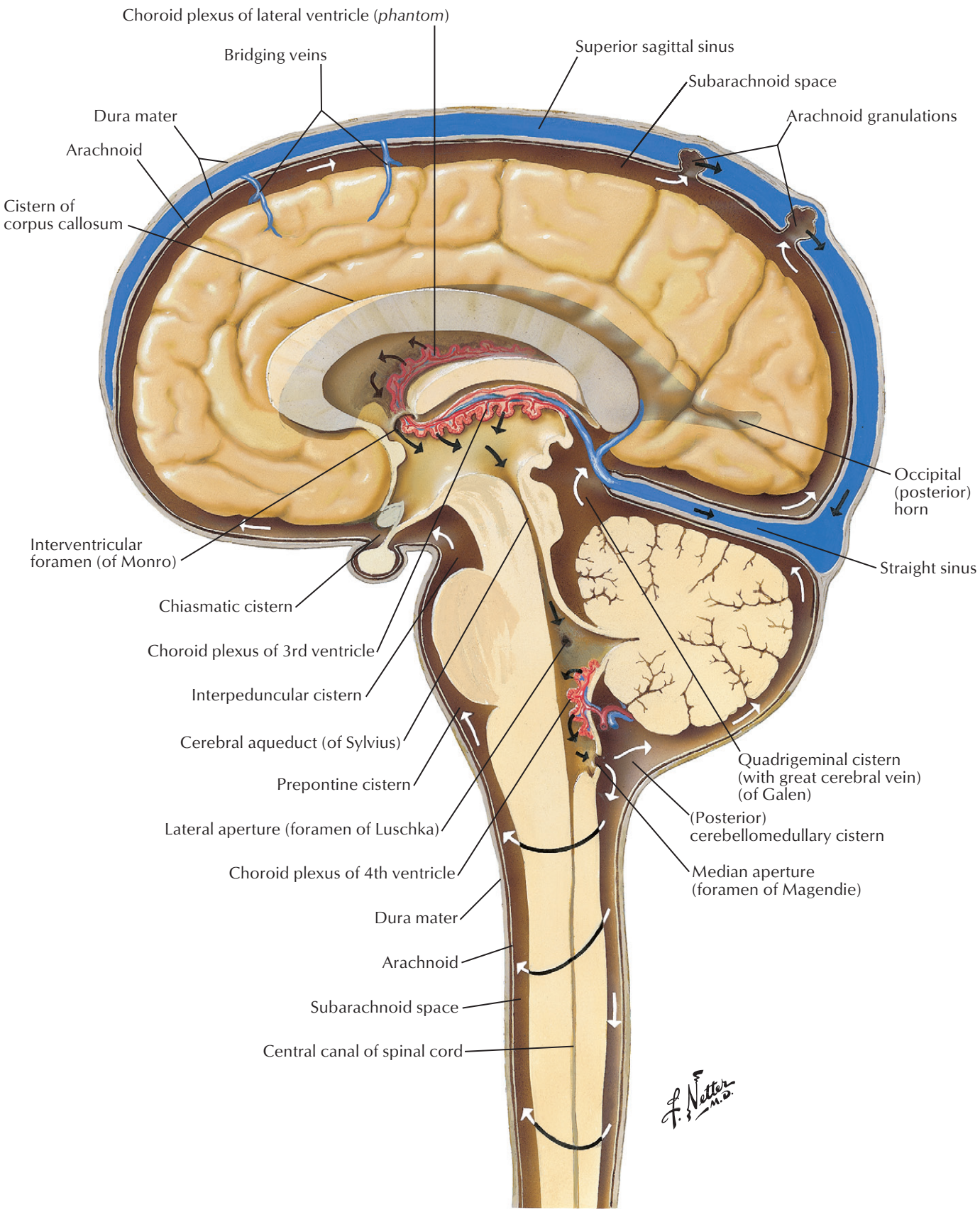




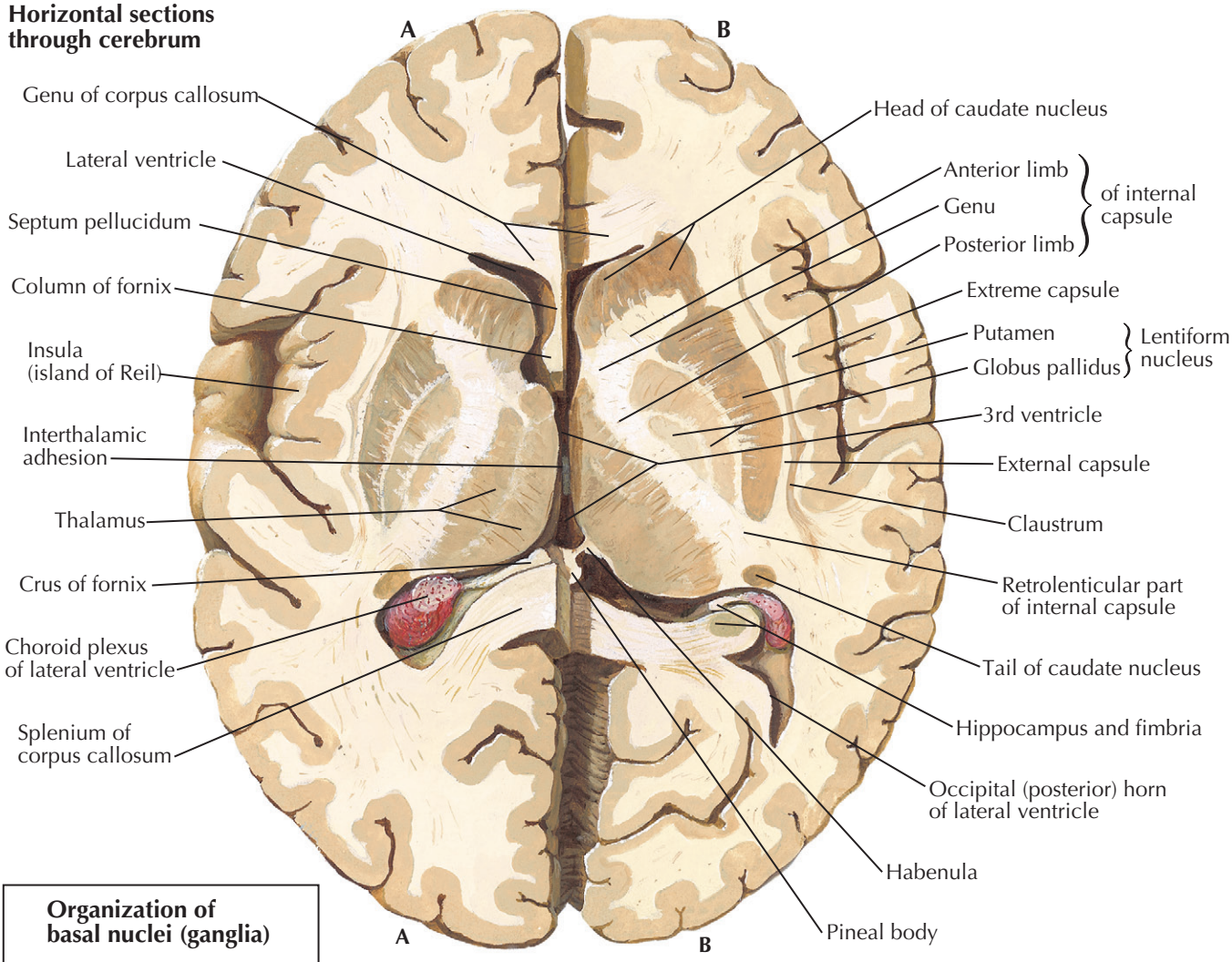
Coronal section of brain: posterior view

Circulation of Cerebrospinal Fluid

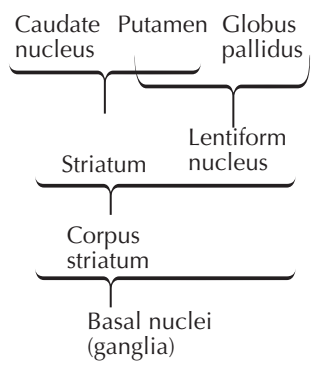
See also Plates 109, 147

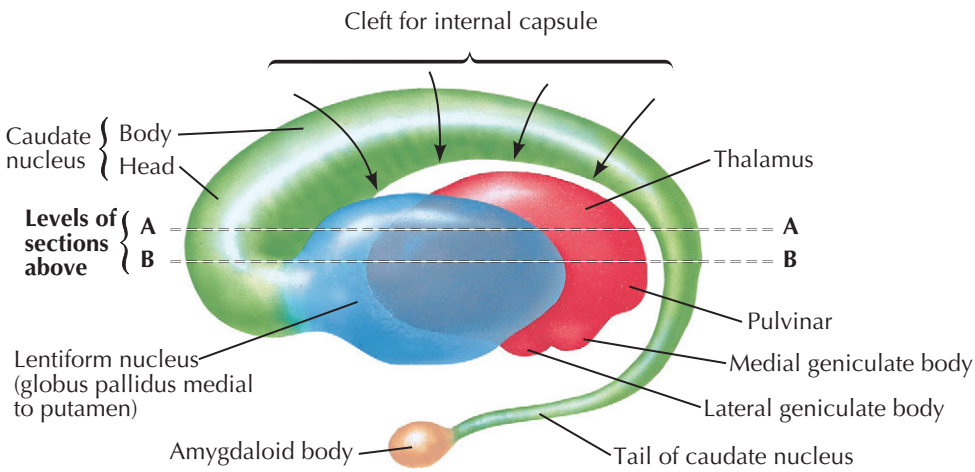


Horizontal sections through cerebrum

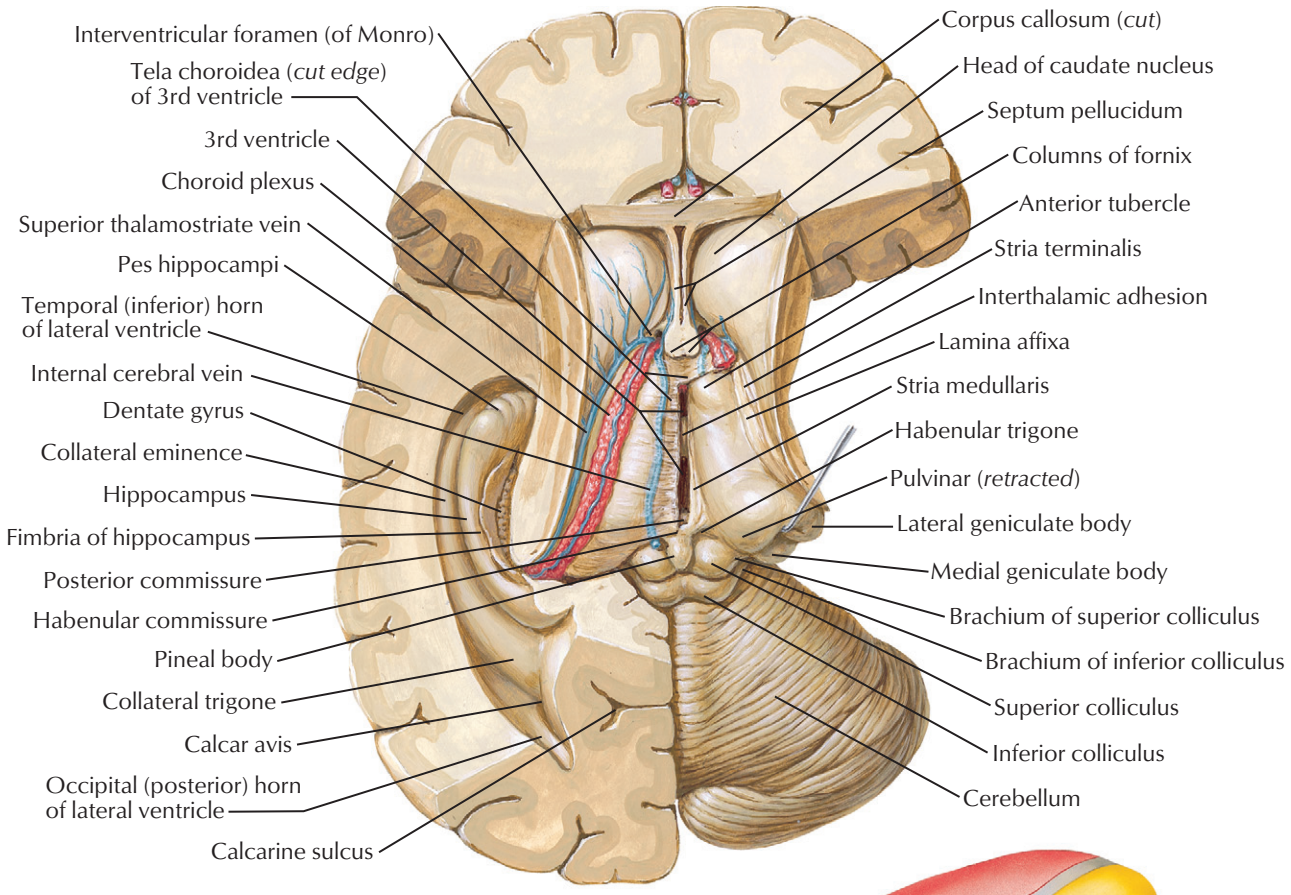


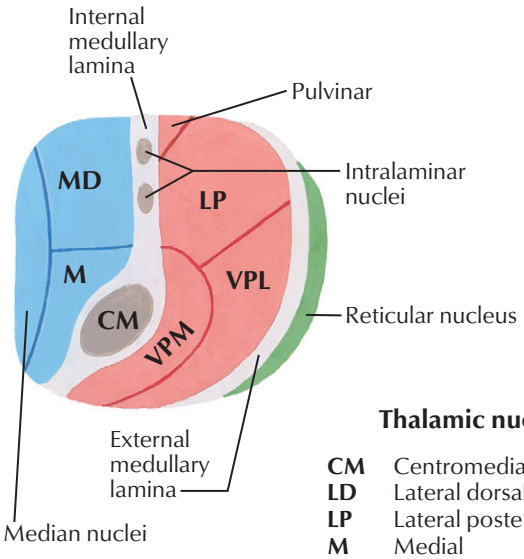
Organization of basal nuclei (ganglia)





Interrelationship of thalamus, lentiform nucleus, caudate nucleus, and amygdaloid body (schema): left lateral view

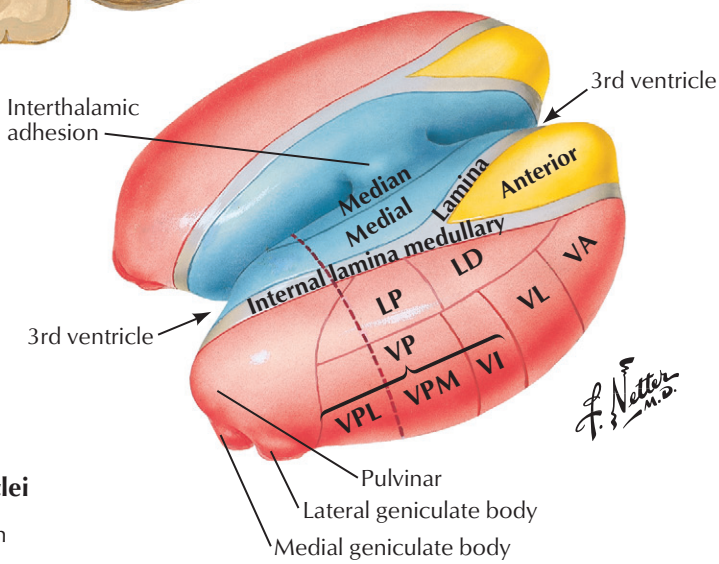




Schematic section through thalamus
(at level of broken line shown in figure at right)

Thalamic nuclei

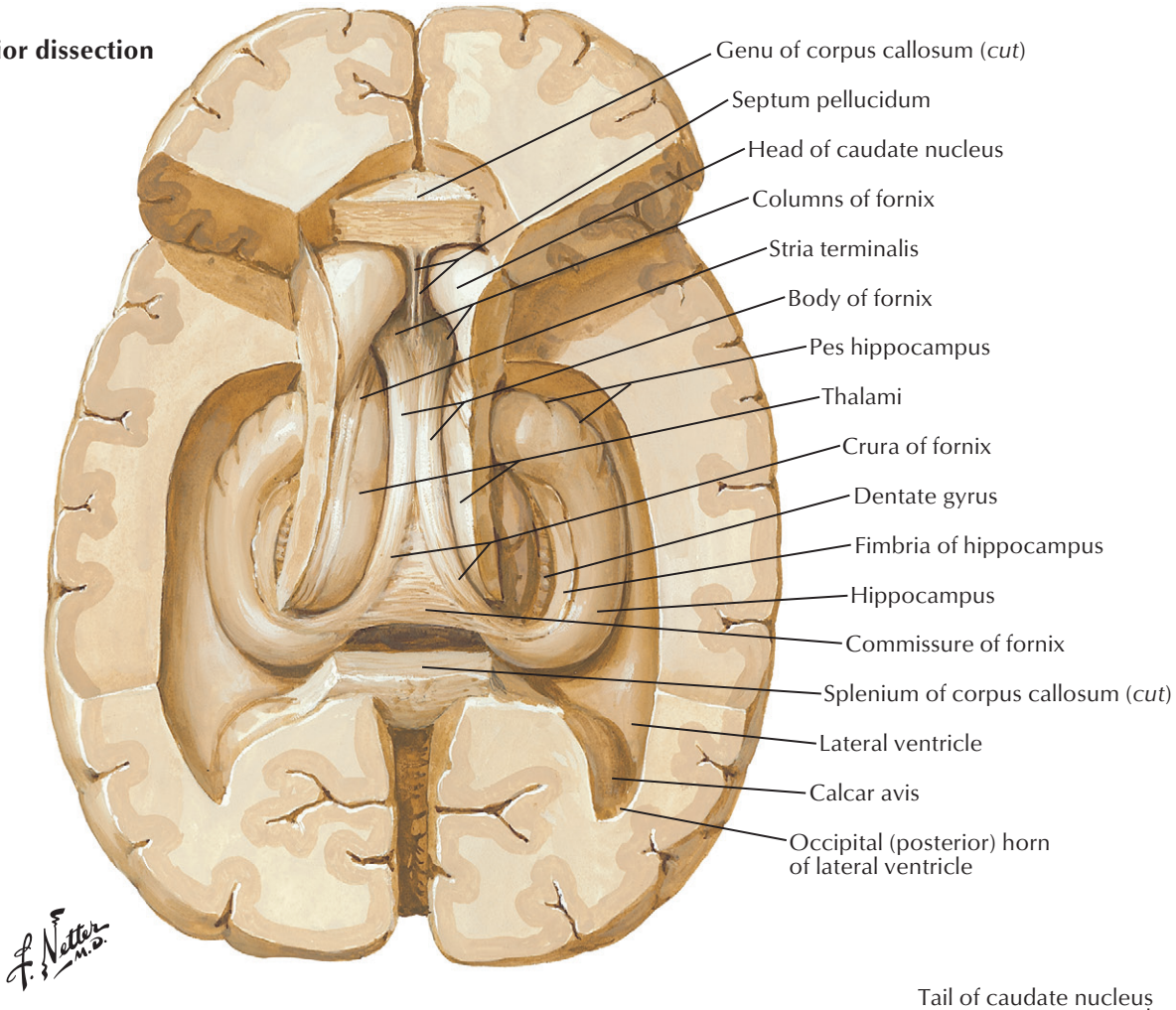
CM	Centromedian
LD	Lateral dorsal
LP	Lateral posterior
M	Medial
MD	Medial dorsal
VA	Ventral anterior
VI	Ventral intermedial
VL	Ventral lateral
VP	Ventral posterior
VPL	Ventral posterolateral
VPM	Ventral posteromedial

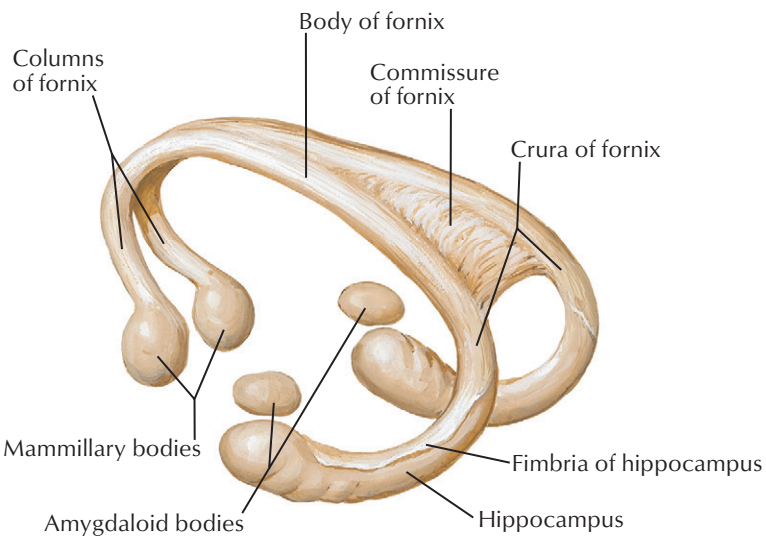


Schematic representation of thalamus
(external medullary lamina and reticular nuclei removed)

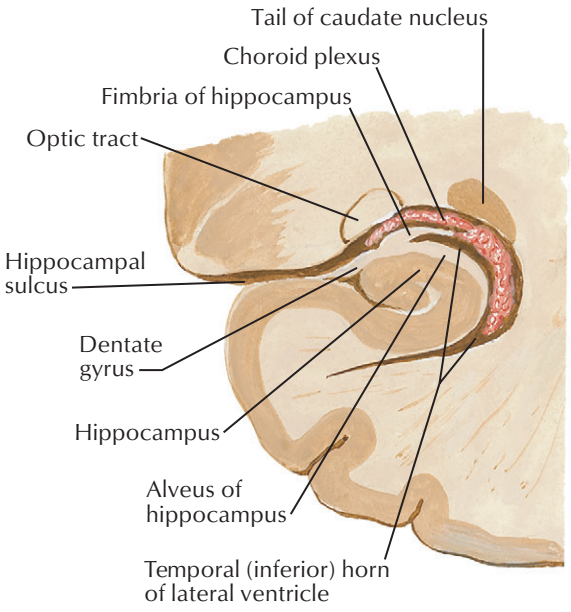
Lateral nuclei
Medial nuclei
Anterior nuclei

Superior dissection

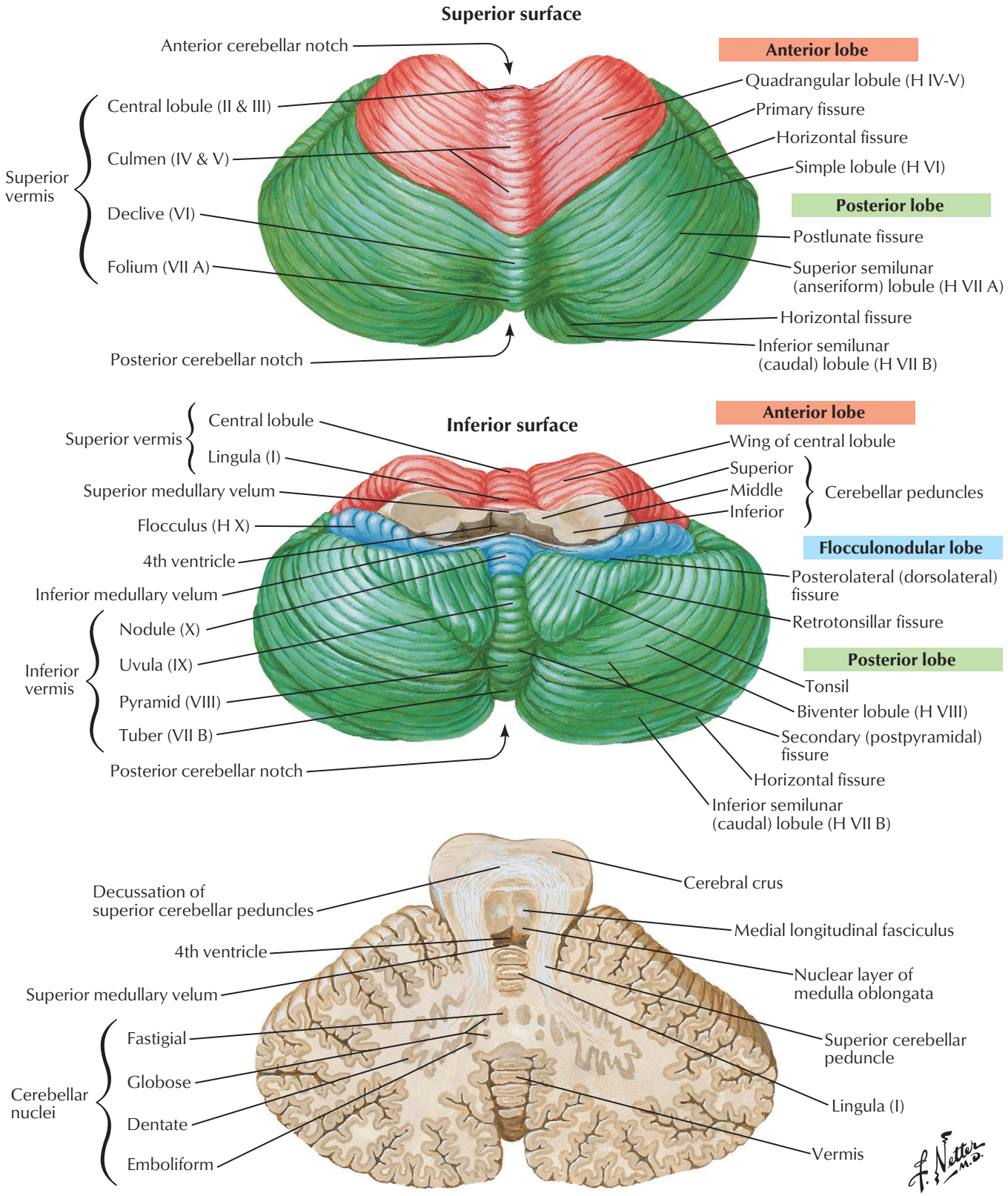




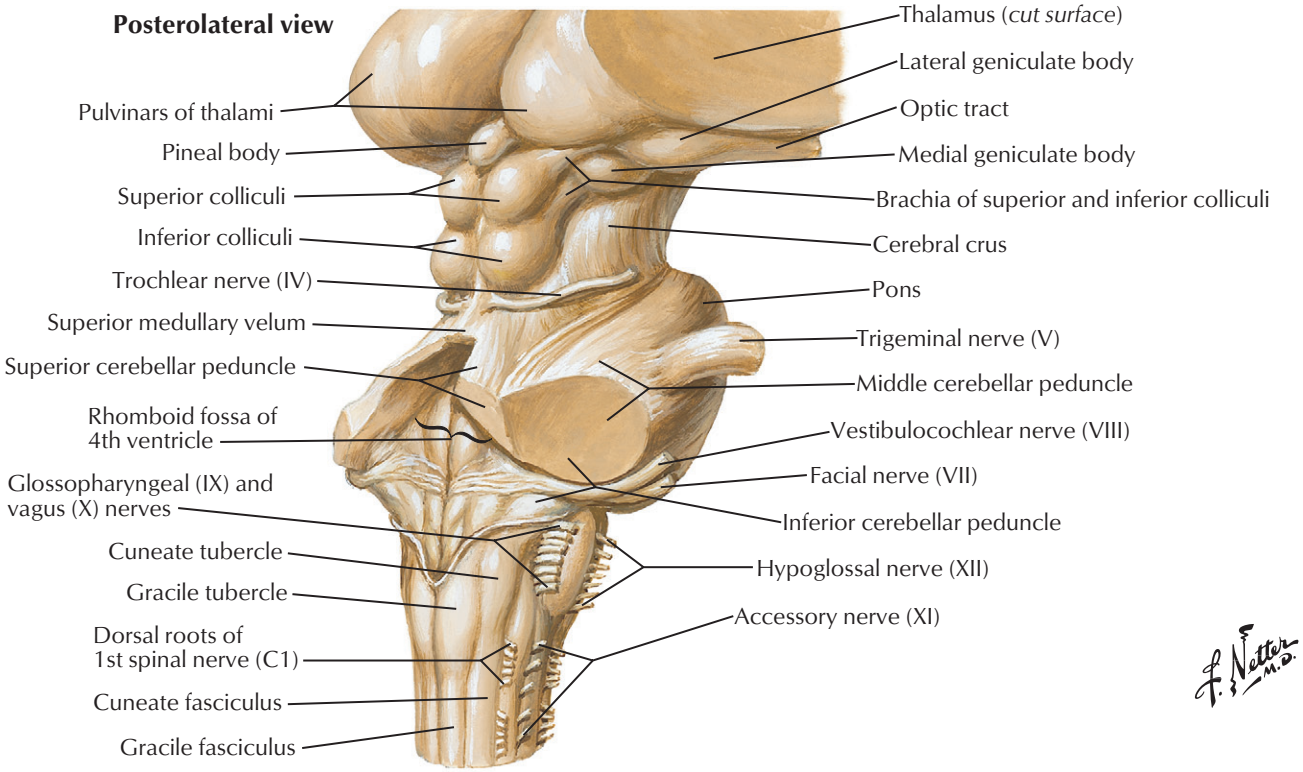
Fornix: schema

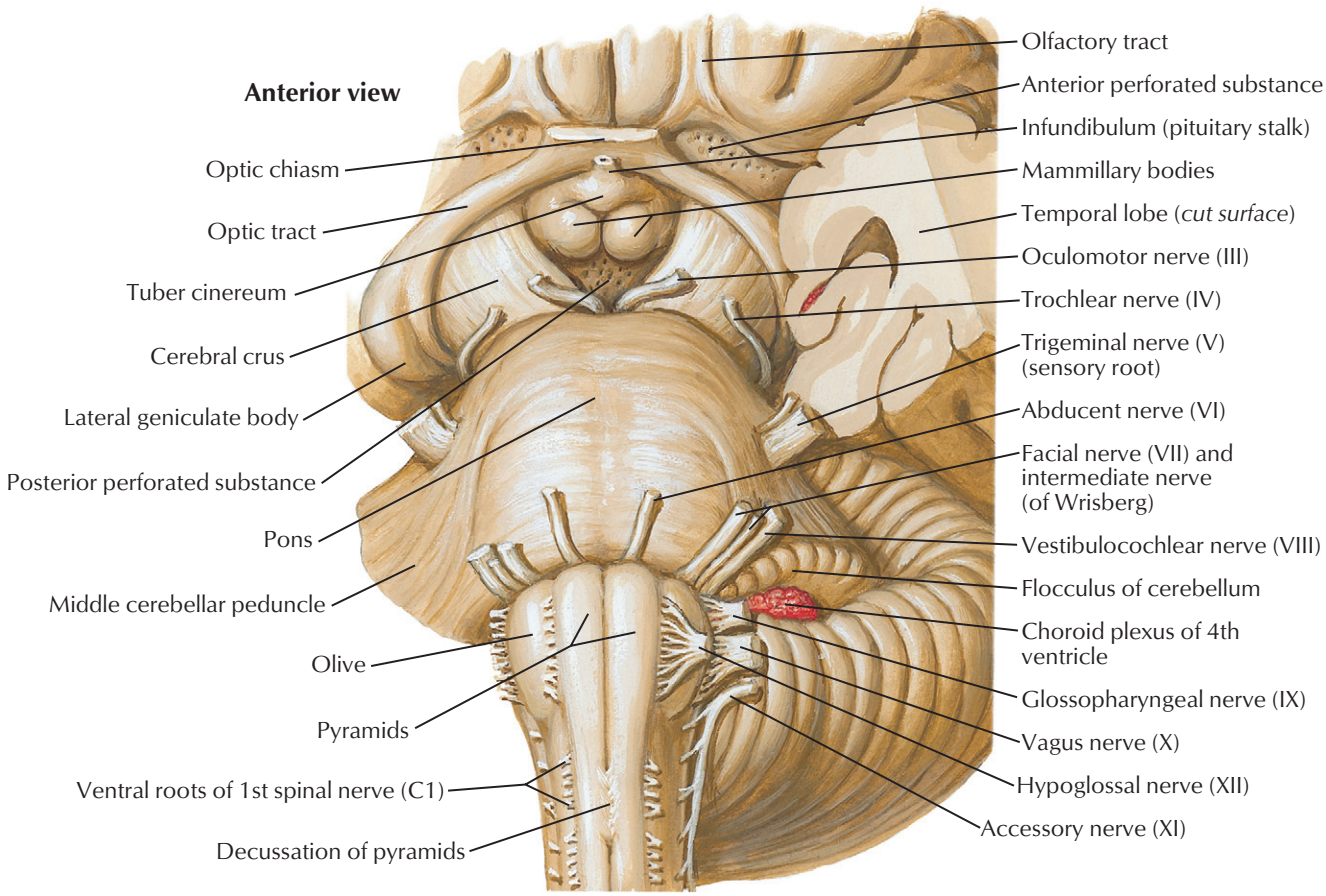


Coronal section: posterior view

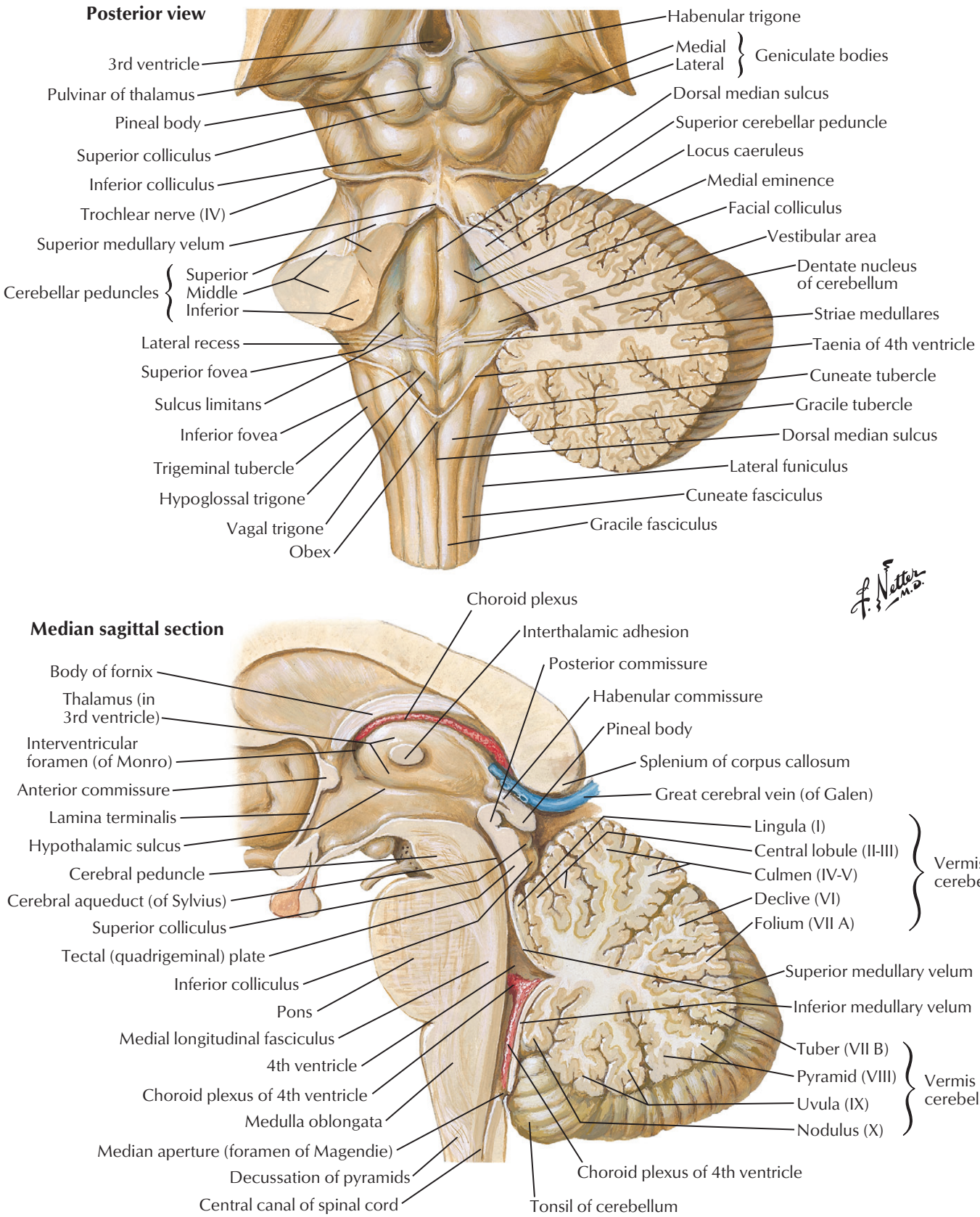


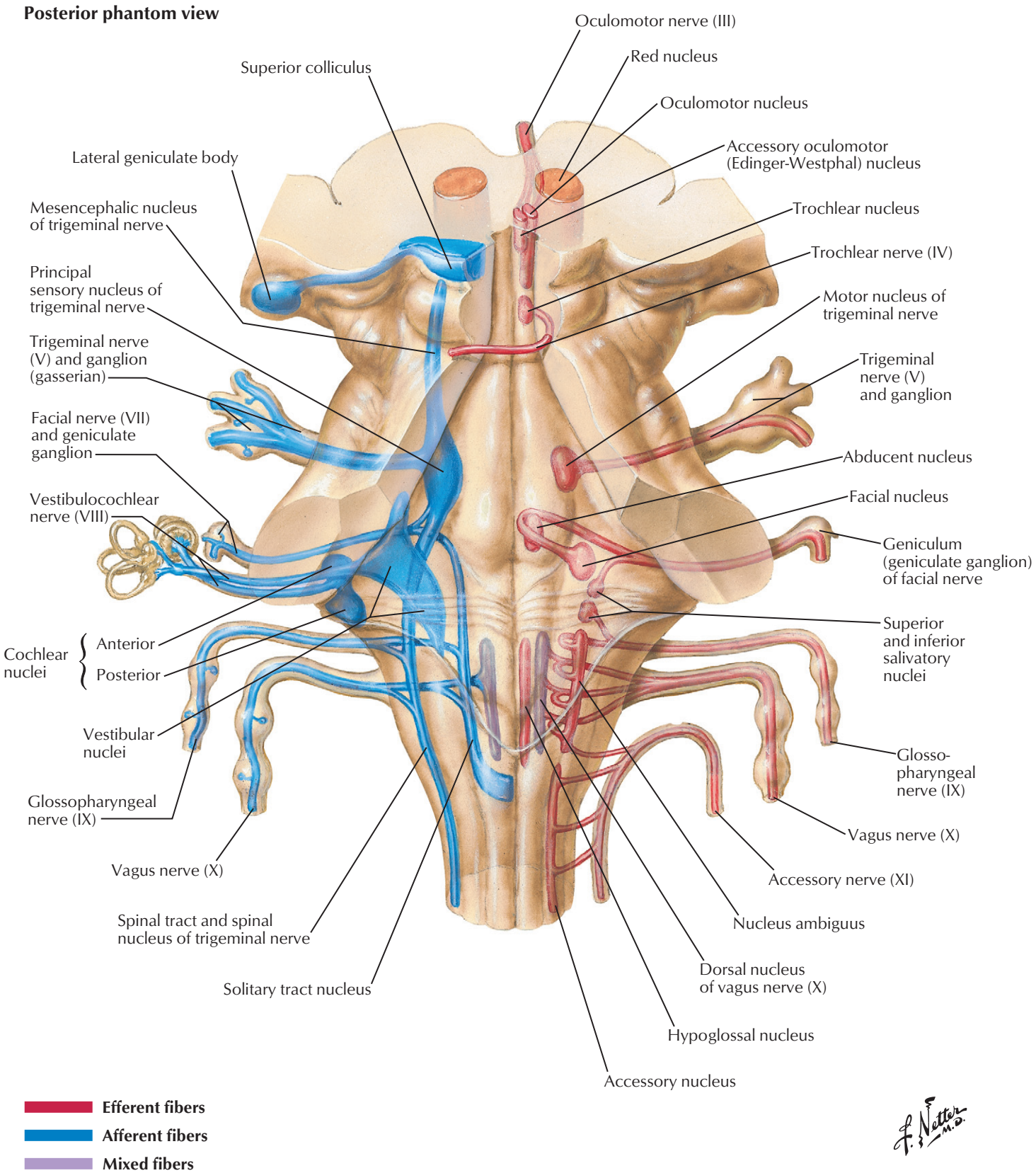
Section in plane of superior cerebellar peduncle


Posterolateral view
Thalamus (cut surface)
Lateral geniculate body
Optic tract
Medial geniculate body
Brachia of superior and inferior colliculi
Cerebral crus
Pons
Trigeminal nerve (V)
Middle cerebellar peduncle
Vestibulocochlear nerve (VIII)
Facial nerve (VII)
Inferior cerebellar peduncle
Hypoglossal nerve (XII)
Accessory nerve (XI)
Pulvinars of thalami
Pineal body
Superior colliculi
Inferior colliculi
Trochlear nerve (IV)
Superior medullary velum
Superior cerebellar peduncle
Rhomboid fossa of 4th ventricle
Glossopharyngeal (IX) and vagus (X) nerves
Cuneate tubercle
Gracile tubercle
Dorsal roots of 1st spinal nerve (C1)
Cuneate fasciculus
Gracile fasciculus

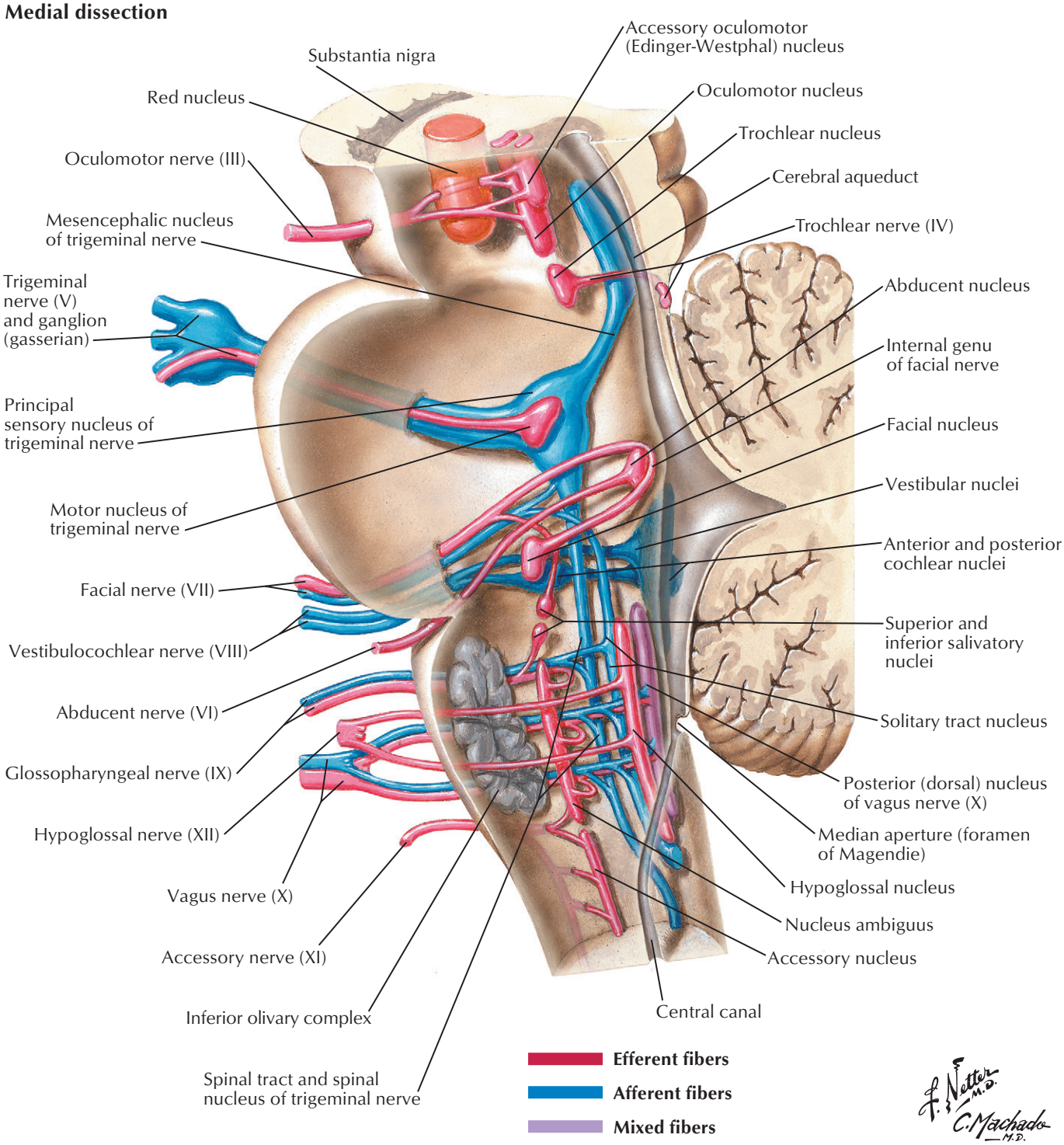

Anterior view
Olfactory tract
Anterior perforated substance
Infundibulum (pituitary stalk)
Mammillary bodies
Temporal lobe (cut surface)
Oculomotor nerve (III)
Trochlear nerve (IV)
Trigeminal nerve (V) (sensory root)
Abducent nerve (VI)
Facial nerve (VII) and intermediate nerve (of Wrisberg)
Vestibulocochlear nerve (VIII)
Flocculus of cerebellum
Choroid plexus of 4th ventricle
Glossopharyngeal nerve (IX)
Vagus nerve (X)
Hypoglossal nerve (XII)
Accessory nerve (XI)
Optic chiasm
Optic tract
Tuber cinereum
Cerebral crus
Lateral geniculate body
Posterior perforated substance
Pons
Middle cerebellar peduncle
Olive
Pyramids
Ventral roots of 1st spinal nerve (C1)
Decussation of pyramids

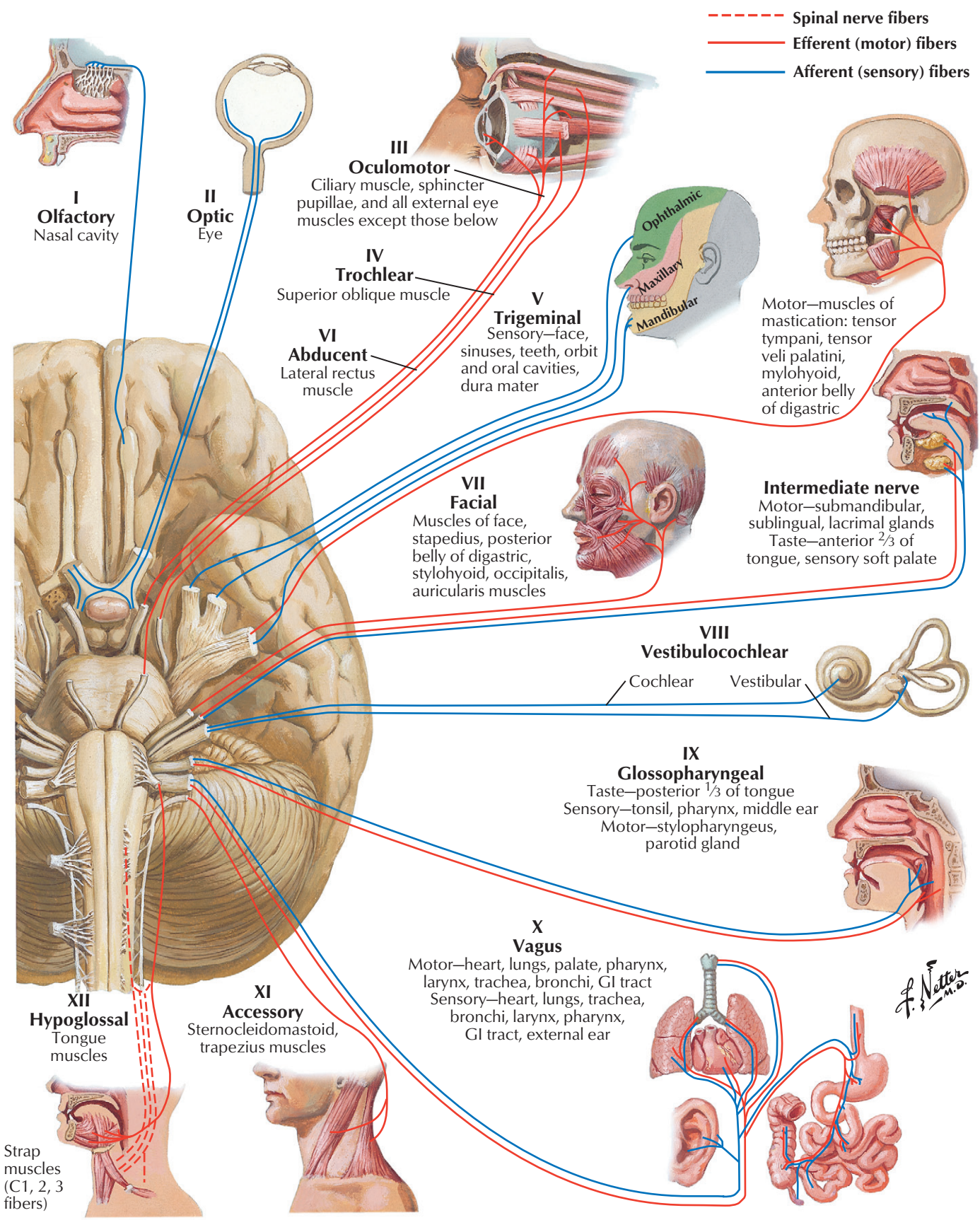
See also Plate 114




Posterior phantom view
Oculomotor nerve (III)
Red nucleus
Superior colliculus
Oculomotor nucleus
Lateral geniculate body
Accessory oculomotor (Edinger-Westphal) nucleus
Mesencephalic nucleus of trigeminal nerve
Trochlear nucleus
Trochlear nerve (IV)
Principal sensory nucleus of trigeminal nerve
Motor nucleus of trigeminal nerve
Trigeminal nerve (V) and ganglion (gasserian)
Trigeminal nerve (V) and ganglion
Facial nerve (VII) and geniculate ganglion
Abducent nucleus
Vestibulocochlear nerve (VIII)
Facial nucleus
Geniculum (geniculate ganglion) of facial nerve
Cochlear nuclei
Anterior
Posterior
Superior and inferior salivatory nuclei
Vestibular nuclei
Glossopharyngeal nerve (IX)
Glosso-pharyngeal nerve (IX)
Vagus nerve (X)
Vagus nerve (X)
Accessory nerve (XI)
Spinal tract and spinal nucleus of trigeminal nerve
Nucleus ambiguus
Dorsal nucleus of vagus nerve (X)
Solitary tract nucleus
Hypoglossal nucleus
Accessory nucleus
Efferent fibers
Afferent fibers
Mixed fibers

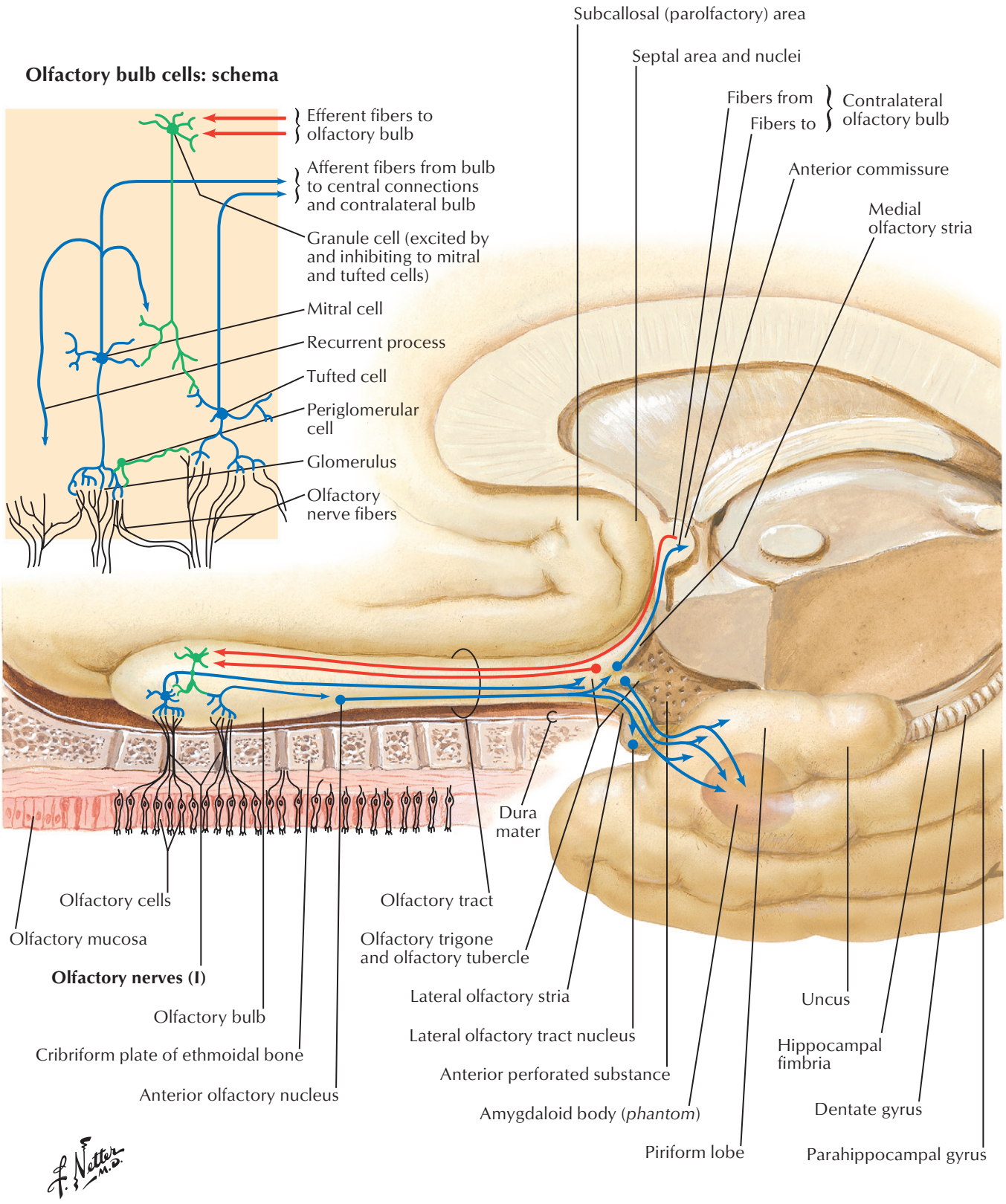
Medial dissection




Spinal nerve fibers
Efferent (motor) fibers
Afferent (sensory) fibers
I
Olfactory
Nasal cavity
II
Optic
Eye
III
Oculomotor
Ciliary muscle, sphincter pupillae, and all external eye muscles except those below
IV
Trochlear
Superior oblique muscle
VI
Abducent
Lateral rectus muscle
V
Trigeminal
Sensory—face, sinuses, teeth, orbit and oral cavities, dura mater
Ophthalmic
Maxillary
Mandibular
Motor—muscles of mastication: tensor tympani, tensor veli palatini, mylohyoid, anterior belly of digastric
VII
Facial
Muscles of face, stapedius, posterior belly of digastric, stylohyoid, occipitalis, auricularis muscles
Intermediate nerve
Motor—submandibular, sublingual, lacrimal glands
Taste—anterior 2/3 of tongue, sensory soft palate
VIII
Vestibulocochlear
Cochlear
Vestibular
IX
Glossopharyngeal
Taste—posterior 1/3 of tongue
Sensory—tonsil, pharynx, middle ear
Motor—stylopharyngeus, parotid gland
X
Vagus
Motor—heart, lungs, palate, pharynx, larynx, trachea, bronchi, GI tract
Sensory—heart, lungs, trachea, bronchi, larynx, pharynx, GI tract, external ear
XI
Accessory
Sternocleidomastoid, trapezius muscles
XII
Hypoglossal
Tongue muscles
Strap muscles (C1, 2, 3 fibers)
F. Netter M.D.

Olfactory Nerve (I): Schema

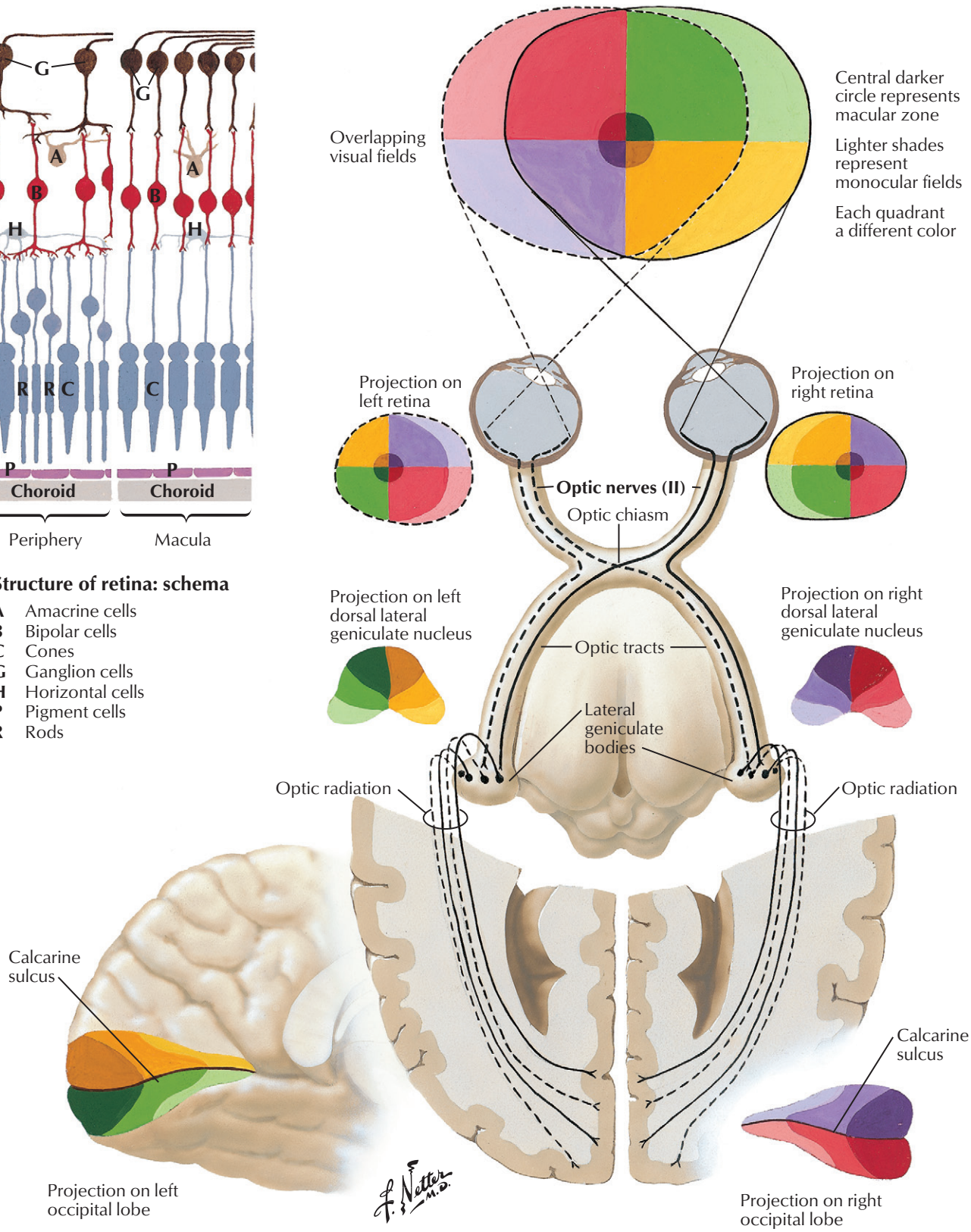
See also Plate 39





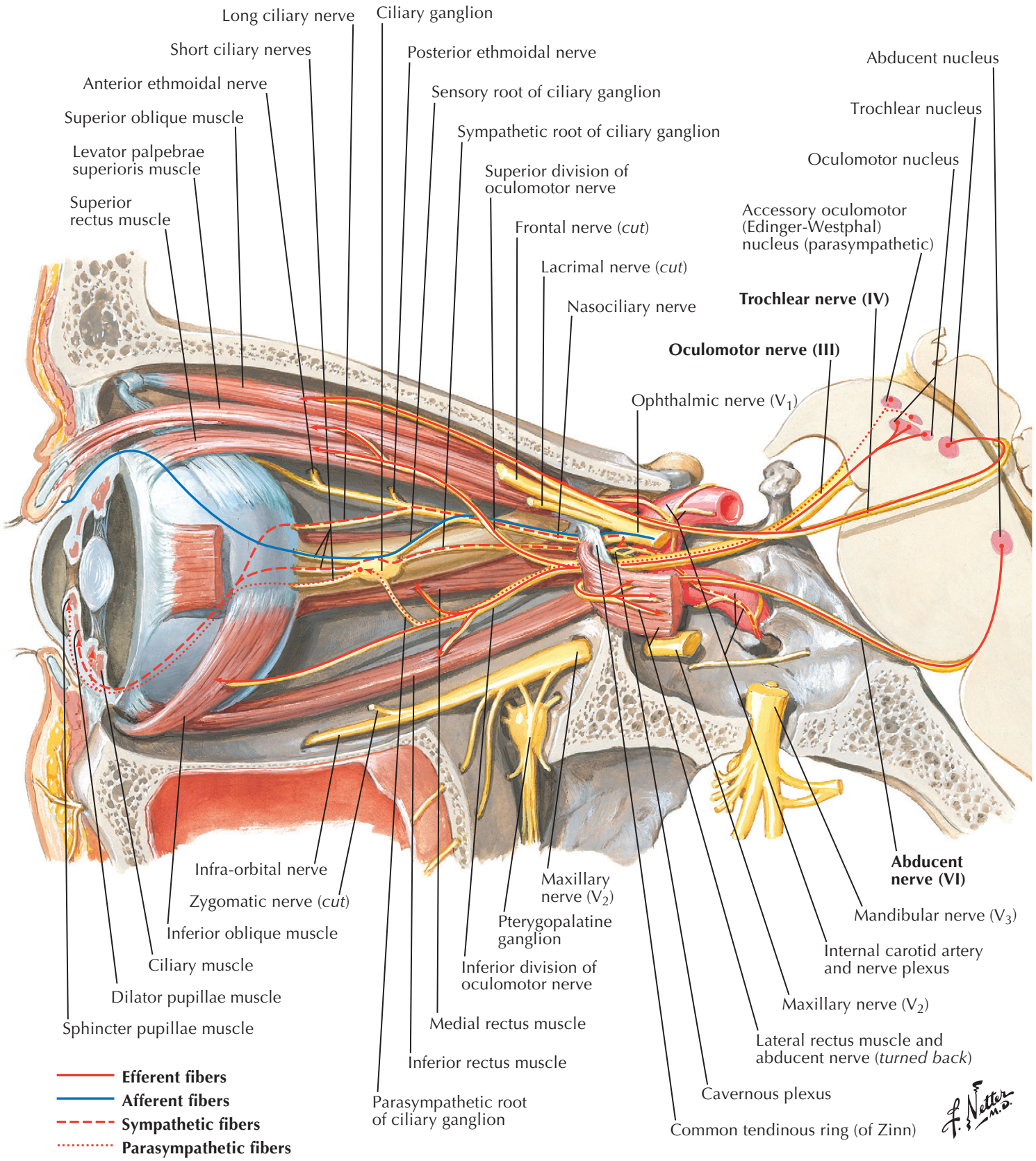
Structure of retina: schema

- **A** Amacrine cells
- **B** Bipolar cells
- **C** Cones
- **G** Ganglion cells
- **H** Horizontal cells
- **P** Pigment cells
- **R** Rods



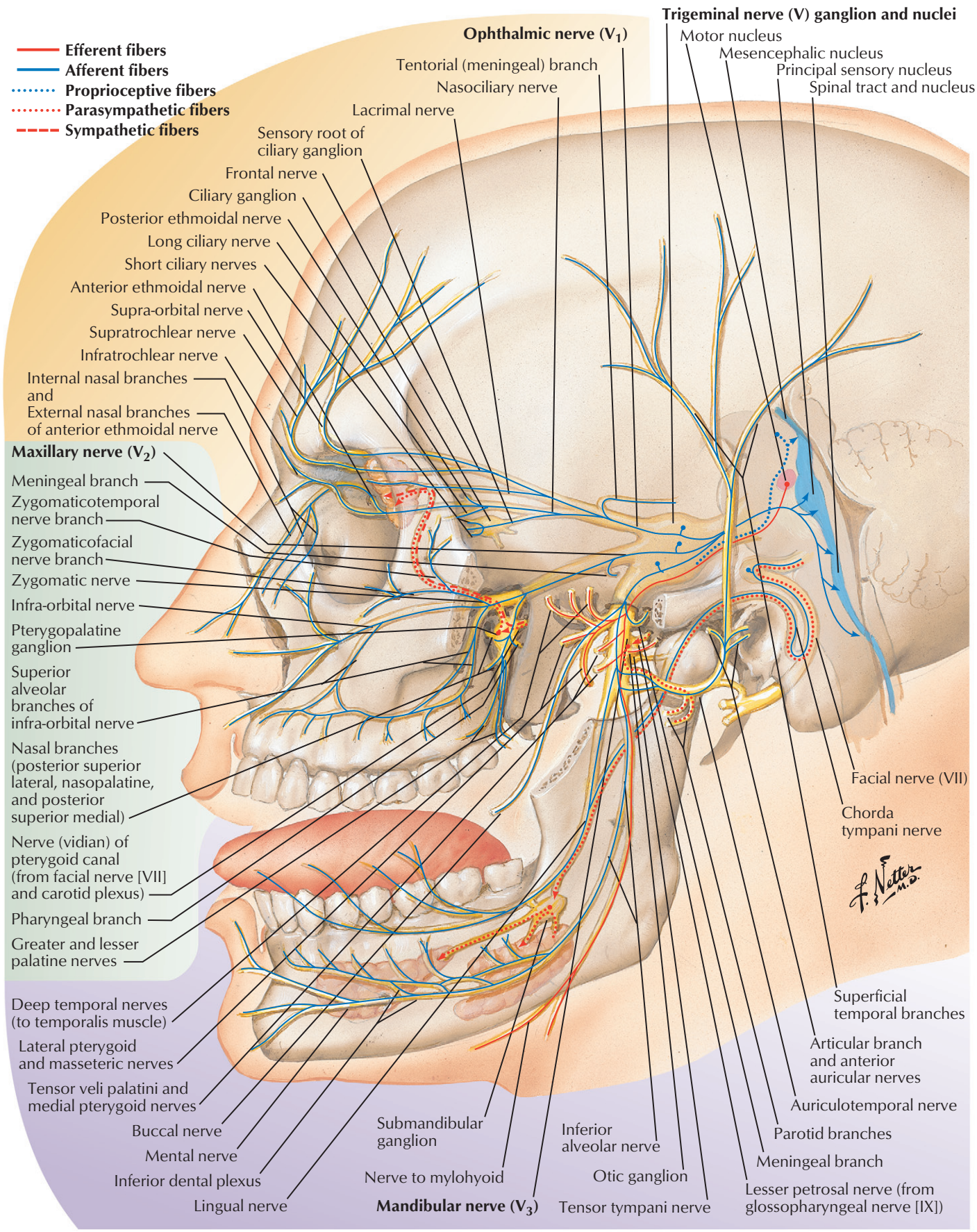
Oculomotor (III), Trochlear (IV), and Abducent (VI) Nerves: Schema

See also Plates 88, 133



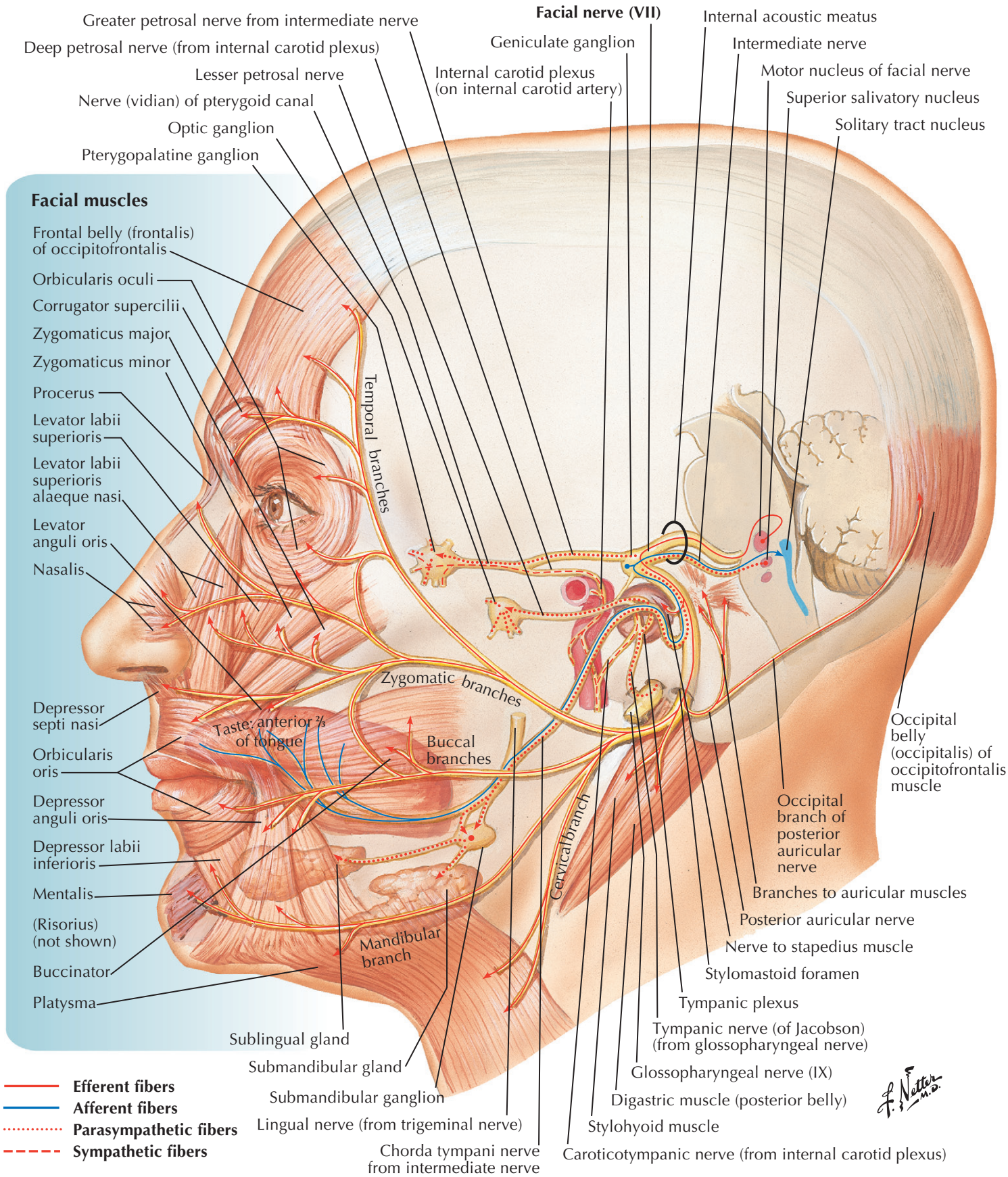
Trigeminal Nerve (V): Schema

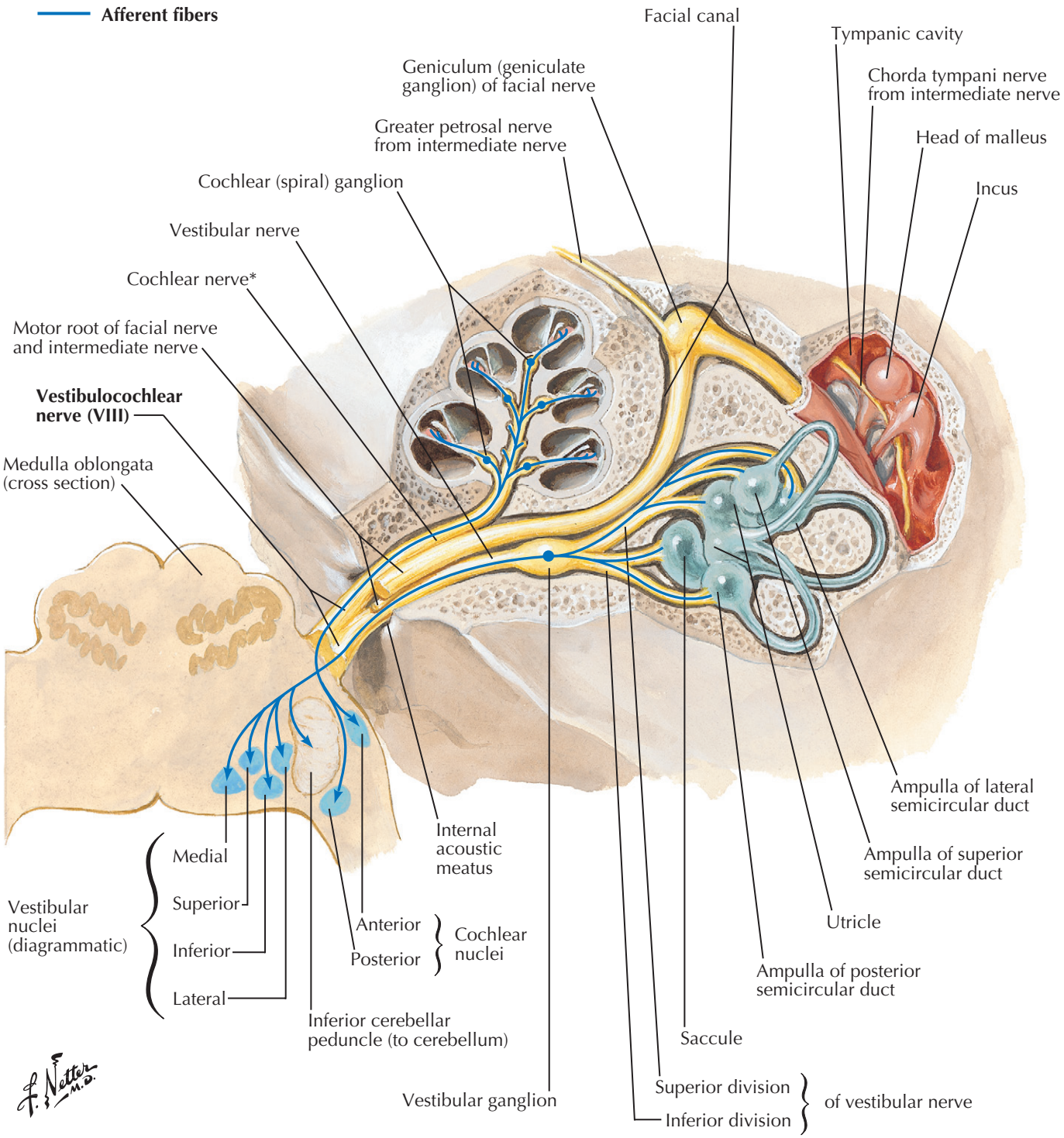
See also Plates 2, 50, 52



Facial Nerve (VII): Schema

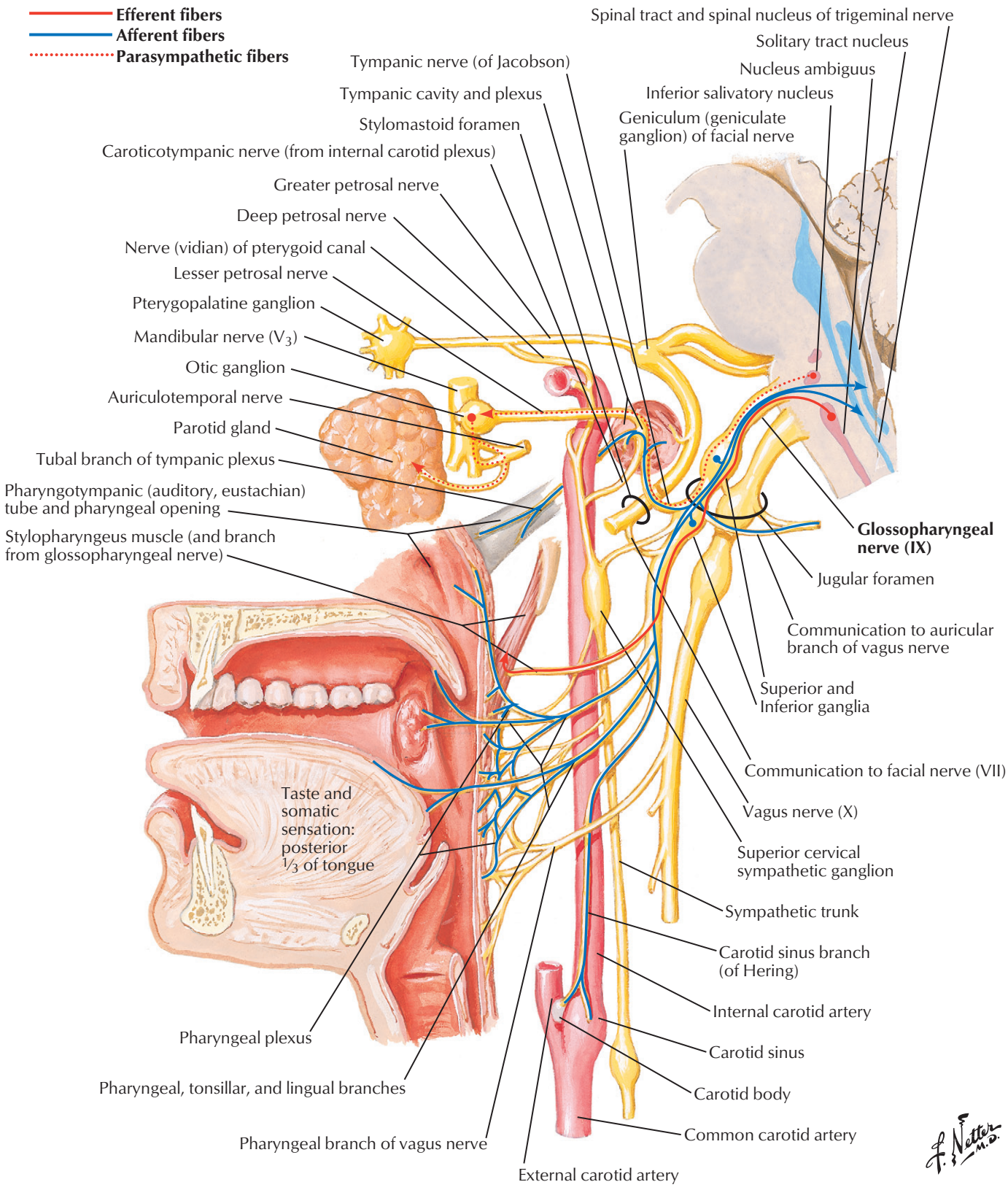
See also Plate 24

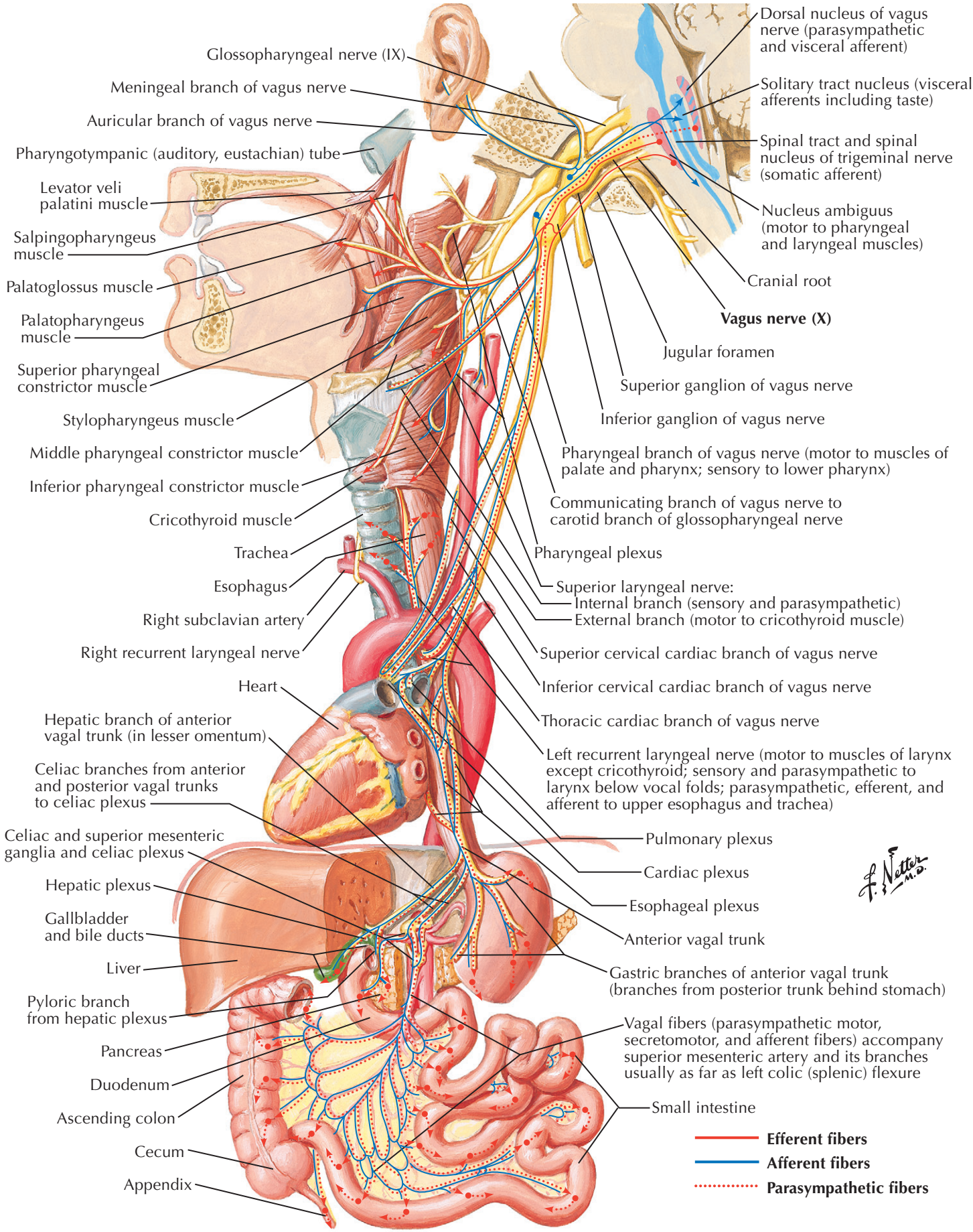




*Note: The cochlear nerve also contains efferent fibers to the sensory epithelium. These fibers are derived from the vestibular nerve while in the internal auditory meatus.

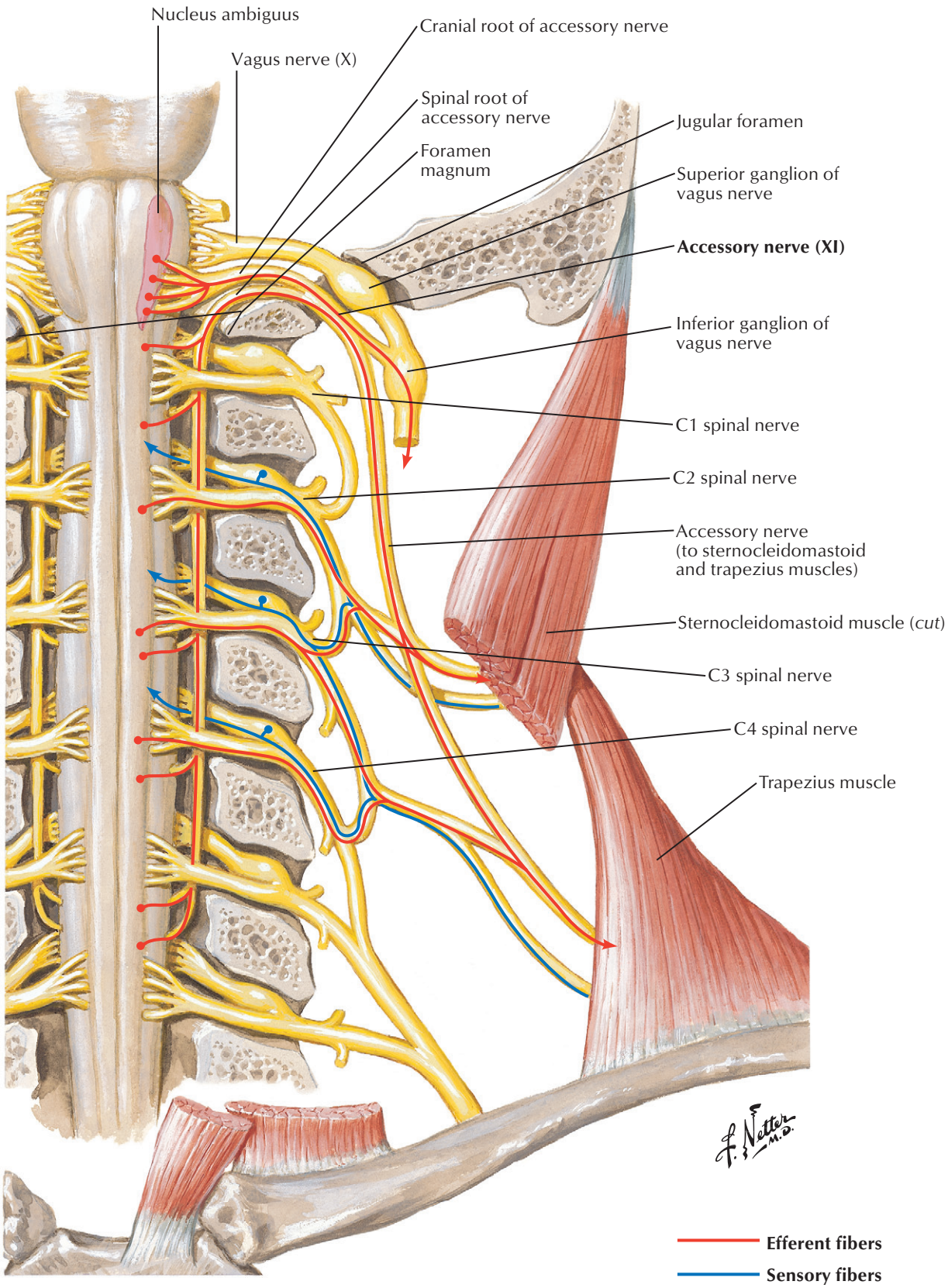
Glossopharyngeal Nerve (IX): Schema




Glossopharyngeal nerve (IX)
Meningeal branch of vagus nerve
Auricular branch of vagus nerve
Pharyngotympanic (auditory, eustachian) tube
Levator veli palatini muscle
Salpingopharyngeus muscle
Palatoglossus muscle
Palatopharyngeus muscle
Superior pharyngeal constrictor muscle
Stylopharyngeus muscle
Middle pharyngeal constrictor muscle
Inferior pharyngeal constrictor muscle
Cricothyroid muscle
Trachea
Esophagus
Right subclavian artery
Right recurrent laryngeal nerve
Heart
Hepatic branch of anterior vagal trunk (in lesser omentum)
Celiac branches from anterior and posterior vagal trunks to celiac plexus
Celiac and superior mesenteric ganglia and celiac plexus
Hepatic plexus
Gallbladder and bile ducts
Liver
Pyloric branch from hepatic plexus
Pancreas
Duodenum
Ascending colon
Cecum
Appendix
Dorsal nucleus of vagus nerve (parasympathetic and visceral afferent)
Solitary tract nucleus (visceral afferents including taste)
Spinal tract and spinal nucleus of trigeminal nerve (somatic afferent)
Nucleus ambiguus (motor to pharyngeal and laryngeal muscles)
Cranial root
Vagus nerve (X)
Jugular foramen
Superior ganglion of vagus nerve
Inferior ganglion of vagus nerve
Pharyngeal branch of vagus nerve (motor to muscles of palate and pharynx; sensory to lower pharynx)
Communicating branch of vagus nerve to carotid branch of glossopharyngeal nerve
Pharyngeal plexus
Superior laryngeal nerve:
Internal branch (sensory and parasympathetic)
External branch (motor to cricothyroid muscle)
Superior cervical cardiac branch of vagus nerve
Inferior cervical cardiac branch of vagus nerve
Thoracic cardiac branch of vagus nerve
Left recurrent laryngeal nerve (motor to muscles of larynx except cricothyroid; sensory and parasympathetic to larynx below vocal folds; parasympathetic, efferent, and afferent to upper esophagus and trachea)
Pulmonary plexus
Cardiac plexus
Esophageal plexus
Anterior vagal trunk
Gastric branches of anterior vagal trunk (branches from posterior trunk behind stomach)
Vagal fibers (parasympathetic motor, secretomotor, and afferent fibers) accompany superior mesenteric artery and its branches usually as far as left colic (splenic) flexure
Small intestine
Efferent fibers
Afferent fibers
Parasympathetic fibers

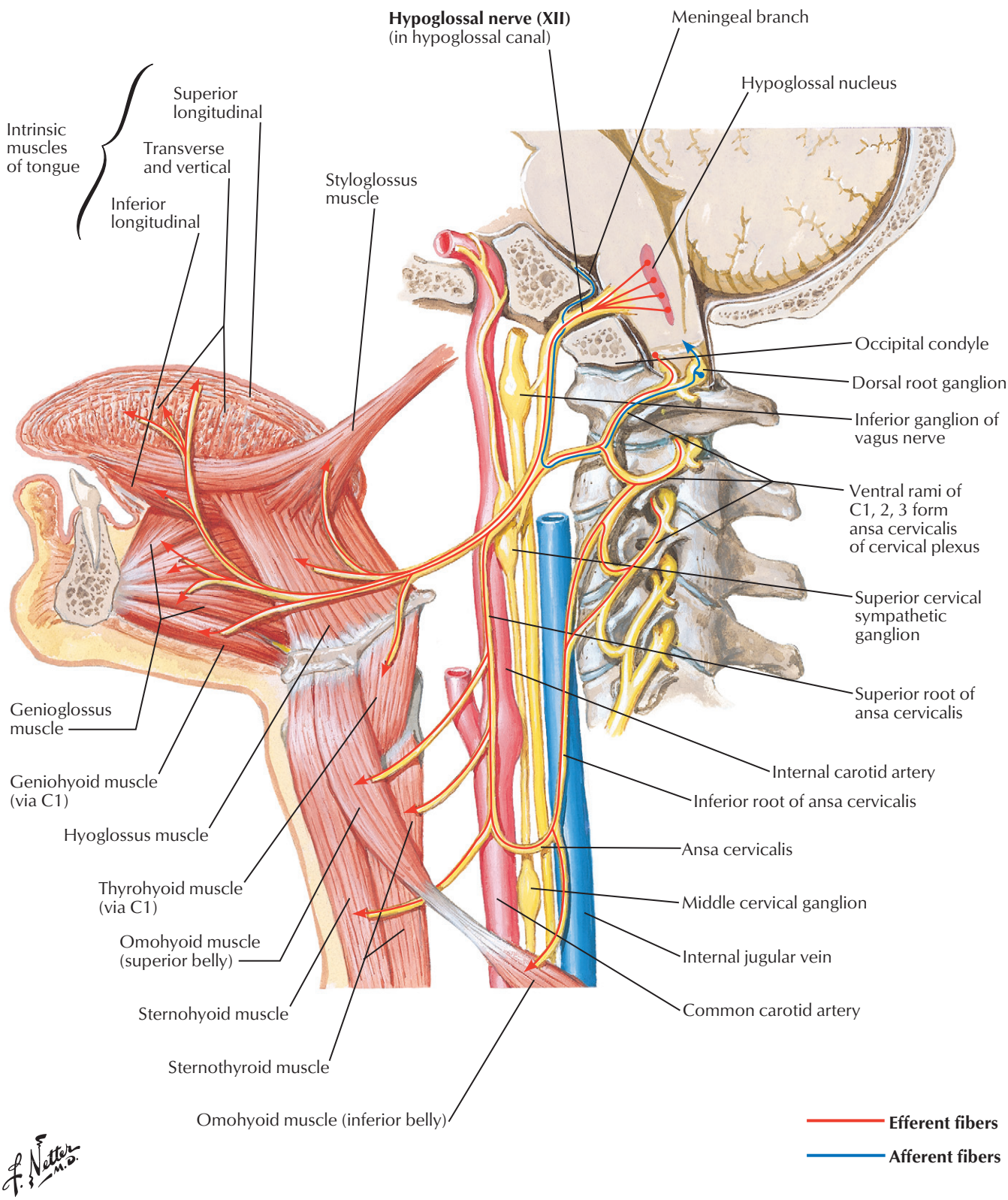
Accessory Nerve (XI): Schema

See also Plate 32



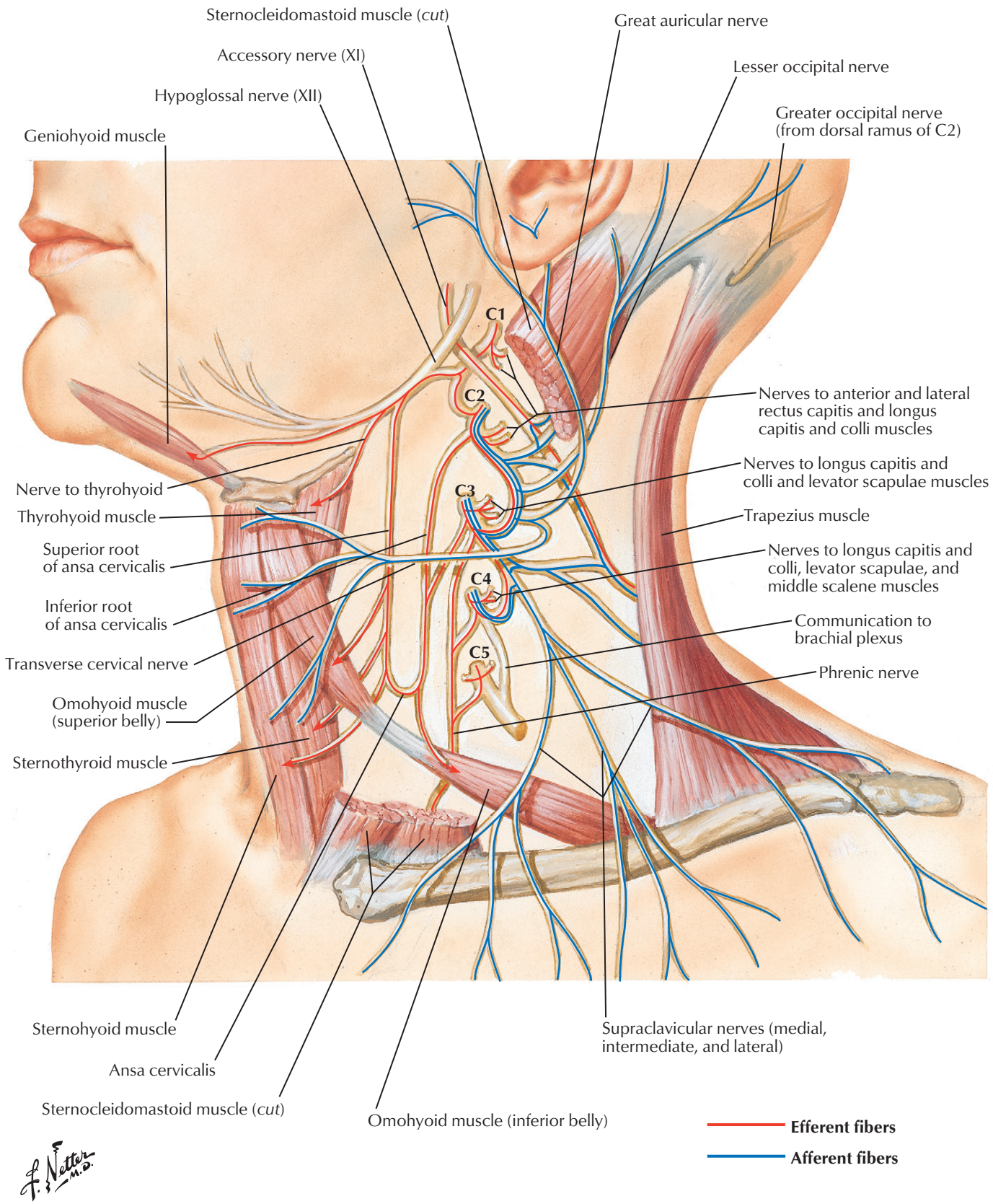
Hypoglossal Nerve (XII): Schema

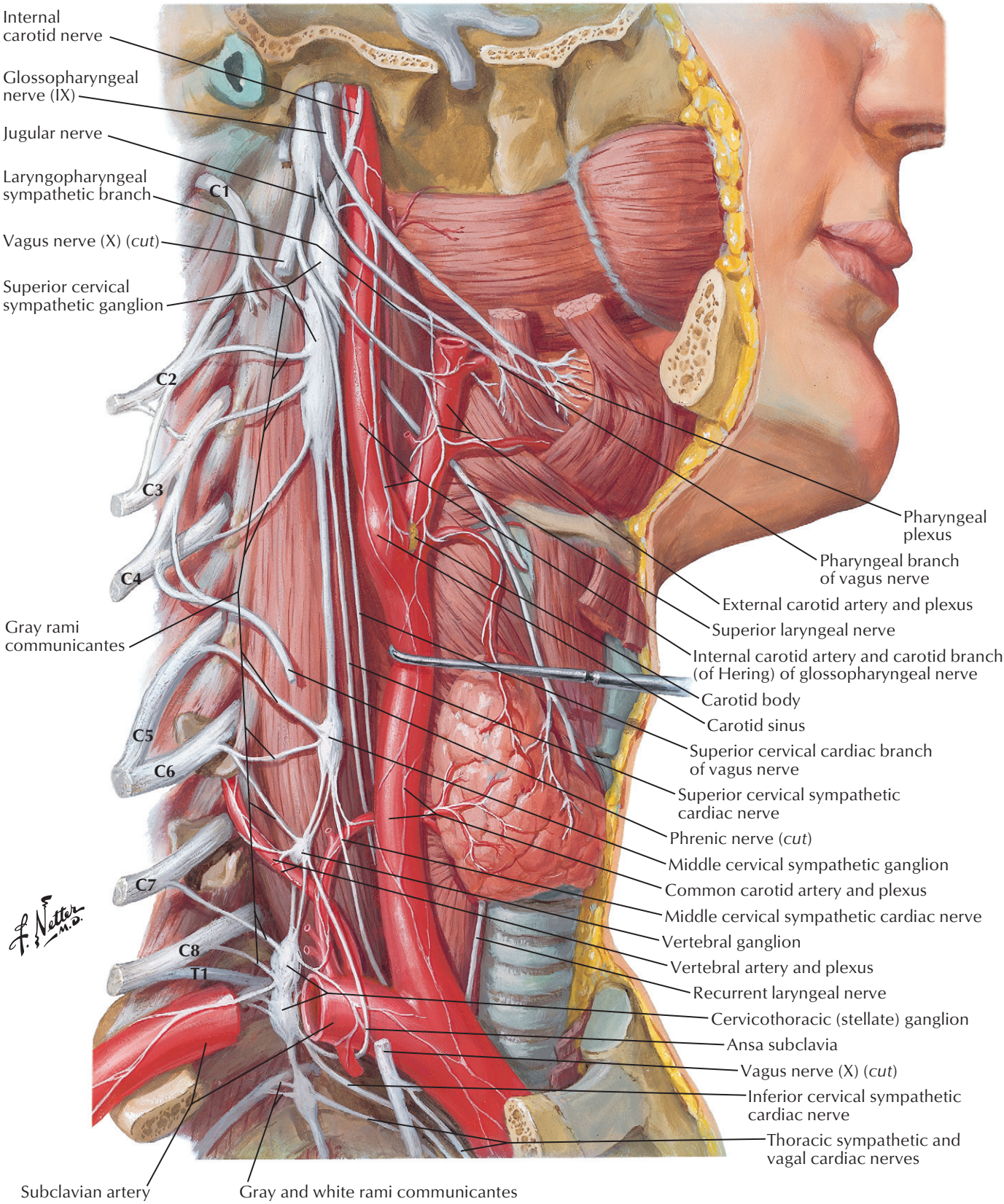
See also Plate 32



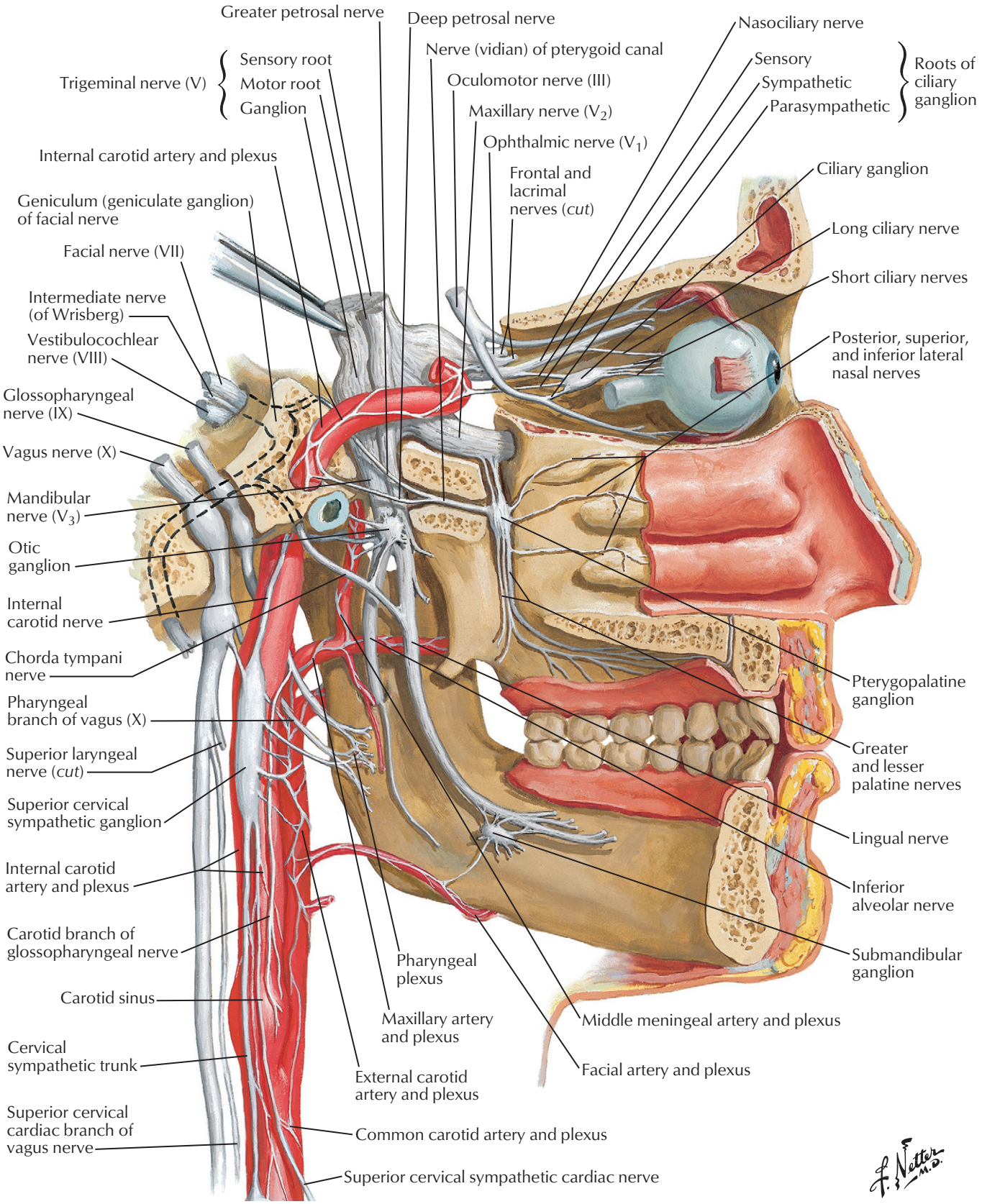
Cervical Plexus: Schema

See also Plates 32, 33



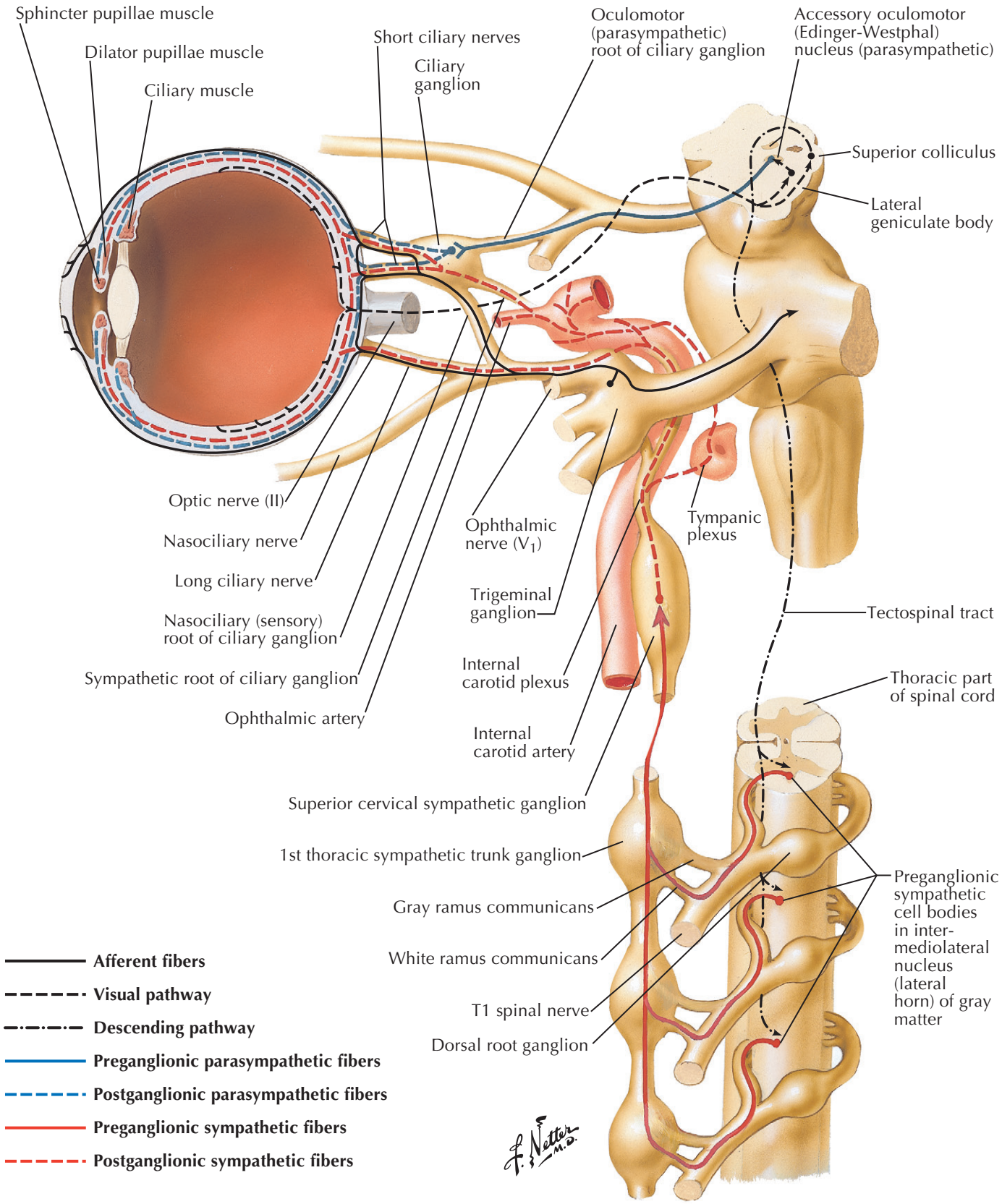

Internal carotid nerve
Glossopharyngeal nerve (IX)
Jugular nerve
Laryngopharyngeal sympathetic branch
Vagus nerve (X) (cut)
Superior cervical sympathetic ganglion
C1
C2
C3
C4
C5
C6
C7
C8
T1
Gray rami communicantes
Subclavian artery
Gray and white rami communicantes
Pharyngeal plexus
Pharyngeal branch of vagus nerve
External carotid artery and plexus
Superior laryngeal nerve
Internal carotid artery and carotid branch (of Hering) of glossopharyngeal nerve
Carotid body
Carotid sinus
Superior cervical cardiac branch of vagus nerve
Superior cervical sympathetic cardiac nerve
Phrenic nerve (cut)
Middle cervical sympathetic ganglion
Common carotid artery and plexus
Middle cervical sympathetic cardiac nerve
Vertebral ganglion
Vertebral artery and plexus
Recurrent laryngeal nerve
Cervicothoracic (stellate) ganglion
Ansa subclavia
Vagus nerve (X) (cut)
Inferior cervical sympathetic cardiac nerve
Thoracic sympathetic and vagal cardiac nerves

See also Plates 53, 123, 134



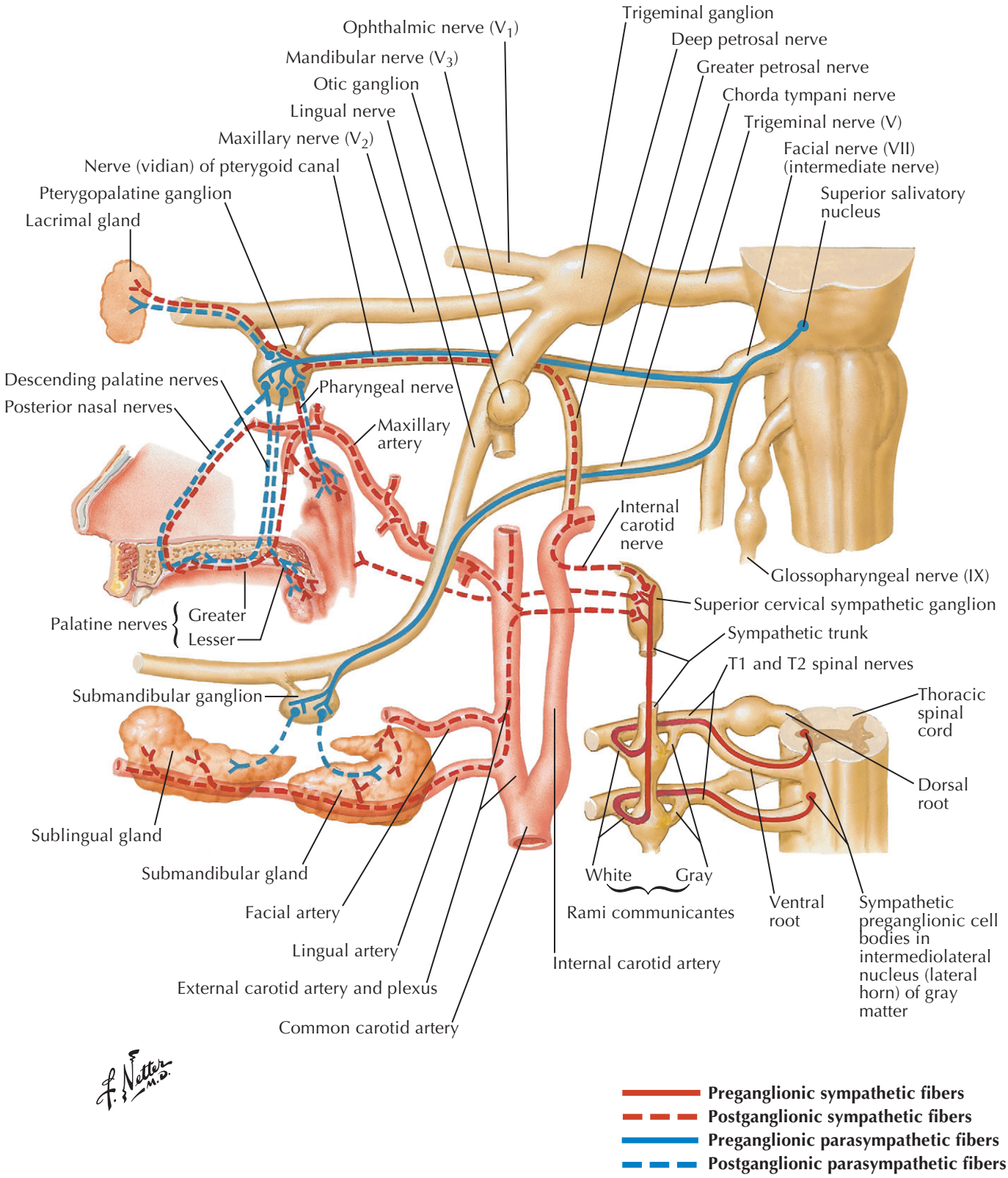
Ciliary Ganglion: Schema

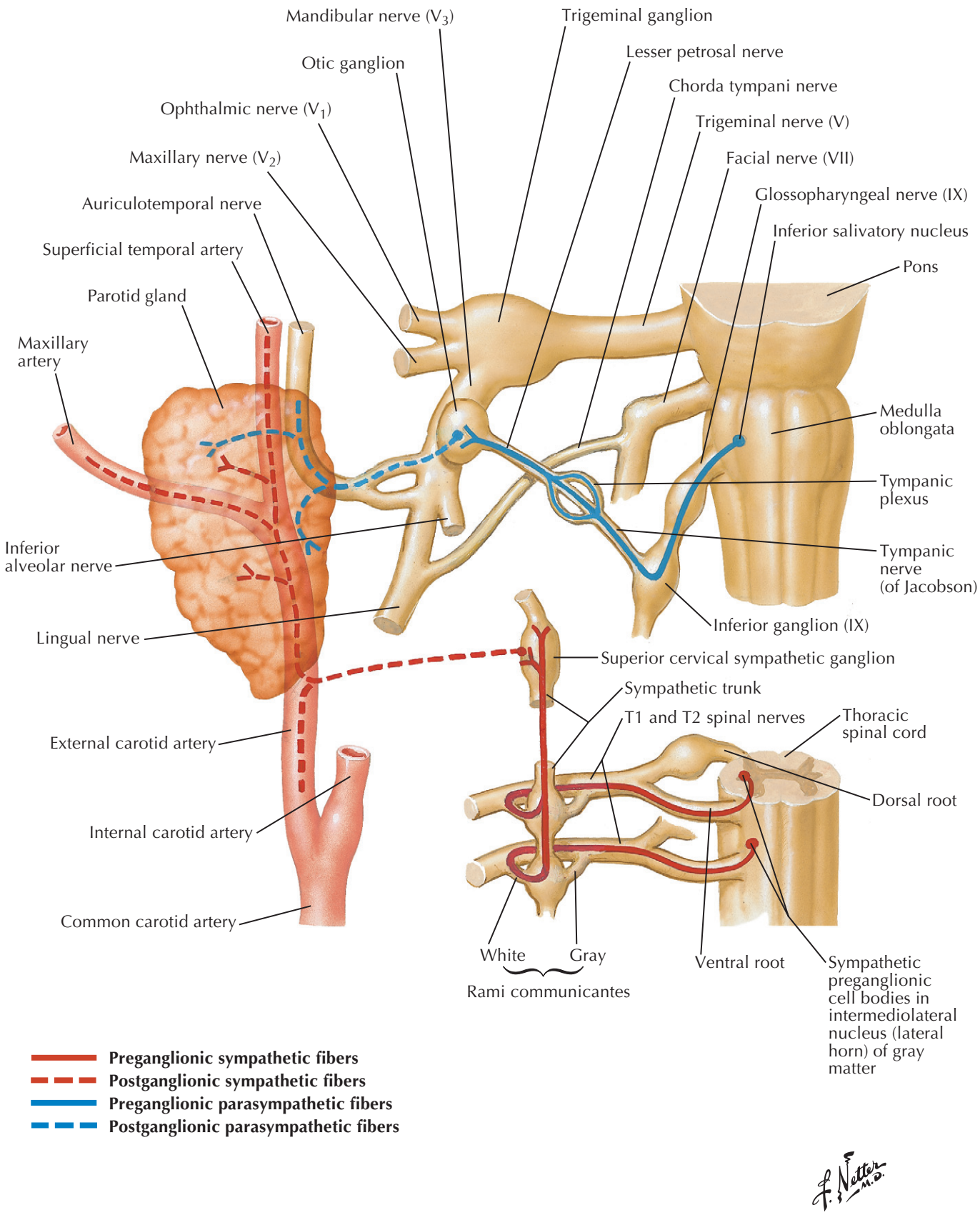
See also Plate 53



Pterygopalatine and Submandibular Ganglia: Schema

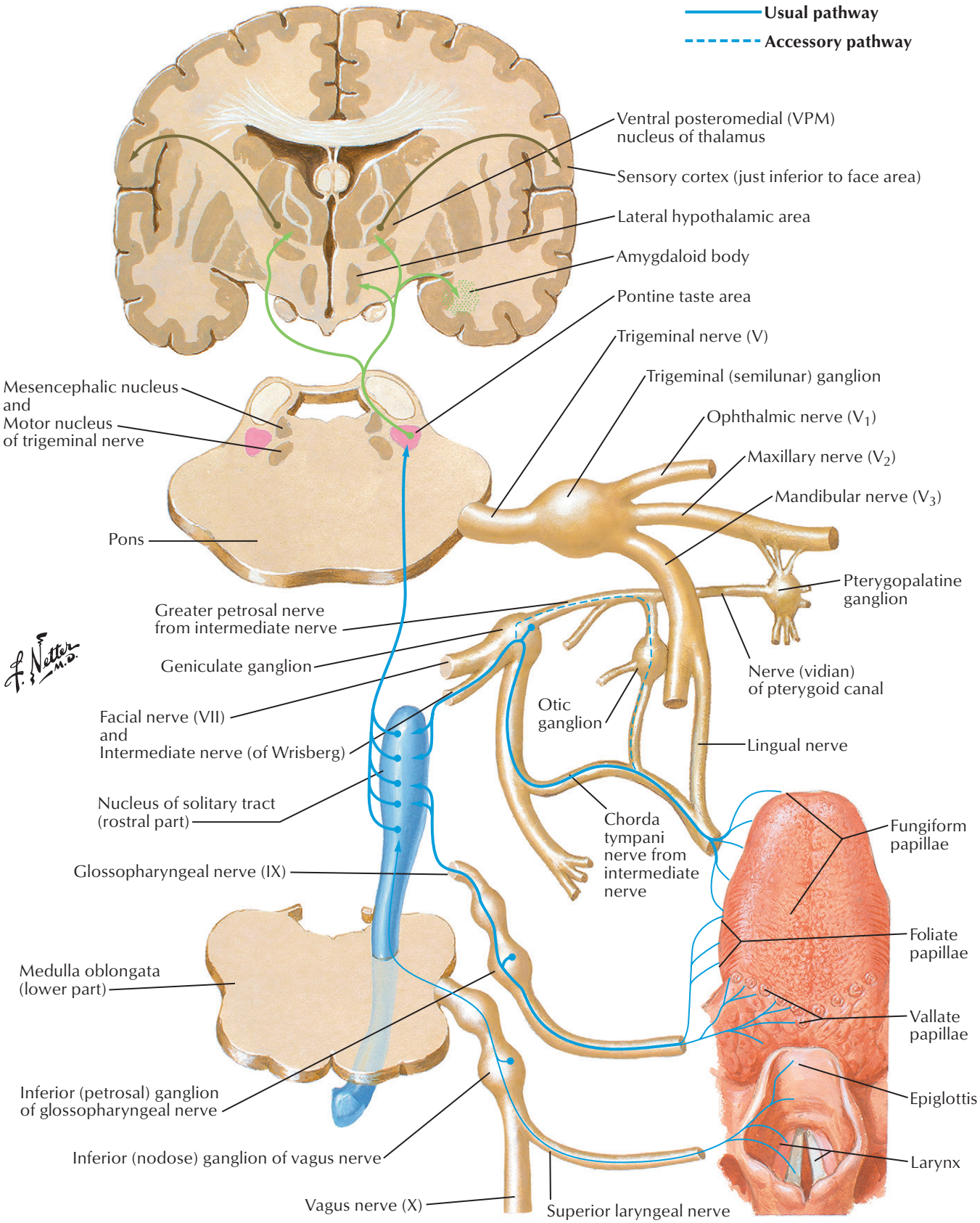
See also Plate 84

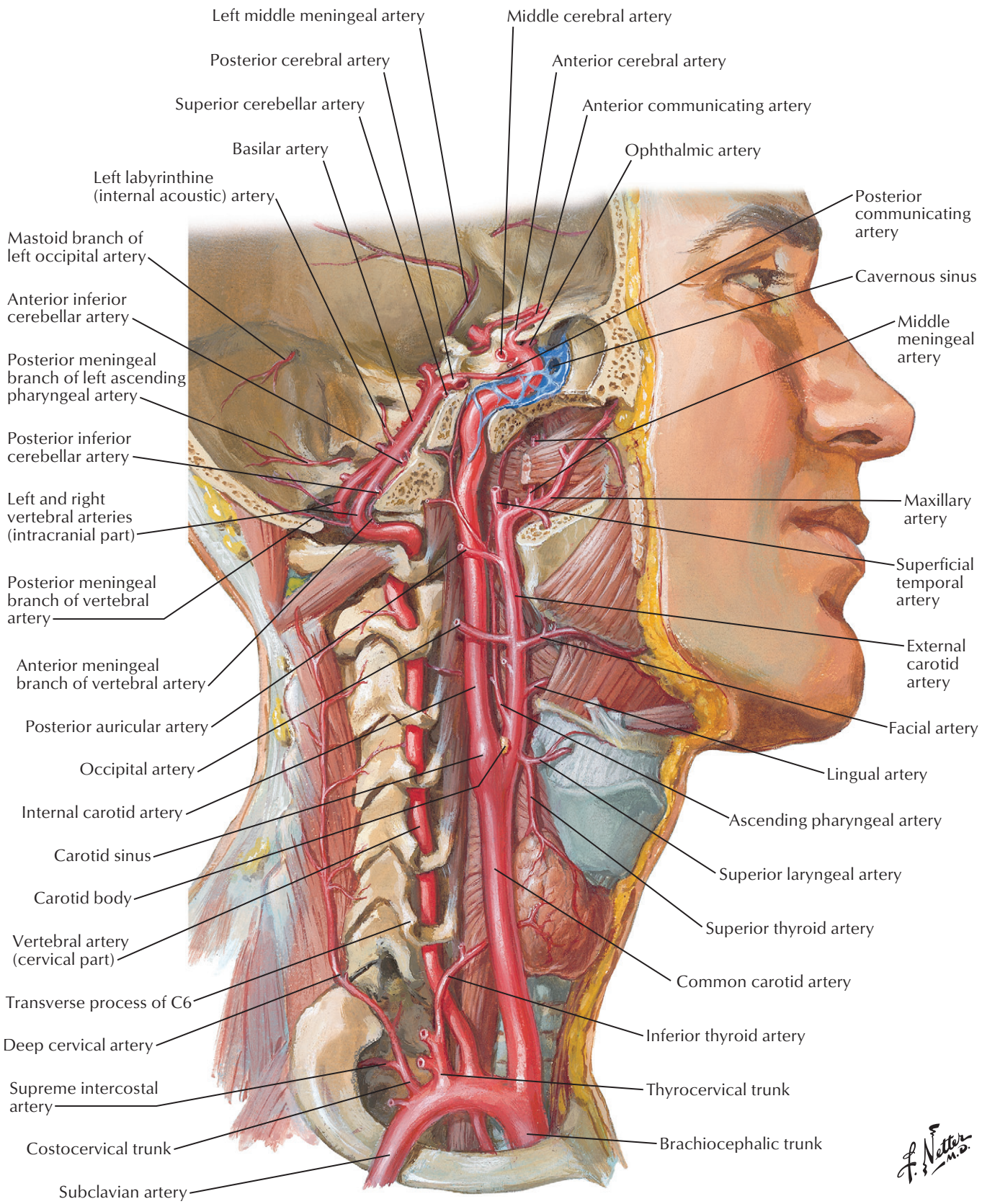



Mandibular nerve (V_3)
Trigeminal ganglion
Otic ganglion
Lesser petrosal nerve
Chorda tympani nerve
Ophthalmic nerve (V_1)
Trigeminal nerve (V)
Maxillary nerve (V_2)
Facial nerve (VII)
Auriculotemporal nerve
Glossopharyngeal nerve (IX)
Inferior salivatory nucleus
Superficial temporal artery
Pons
Parotid gland
Maxillary artery
Medulla oblongata
Tympanic plexus
Inferior alveolar nerve
Tympanic nerve (of Jacobson)
Inferior ganglion (IX)
Lingual nerve
Superior cervical sympathetic ganglion
Sympathetic trunk
T1 and T2 spinal nerves
Thoracic spinal cord
External carotid artery
Dorsal root
Internal carotid artery
Common carotid artery
White
Gray
Rami communicantes
Ventral root
Sympathetic preganglionic cell bodies in intermediolateral nucleus (lateral horn) of gray matter
Preganglionic sympathetic fibers
Postganglionic sympathetic fibers
Preganglionic parasympathetic fibers
Postganglionic parasympathetic fibers

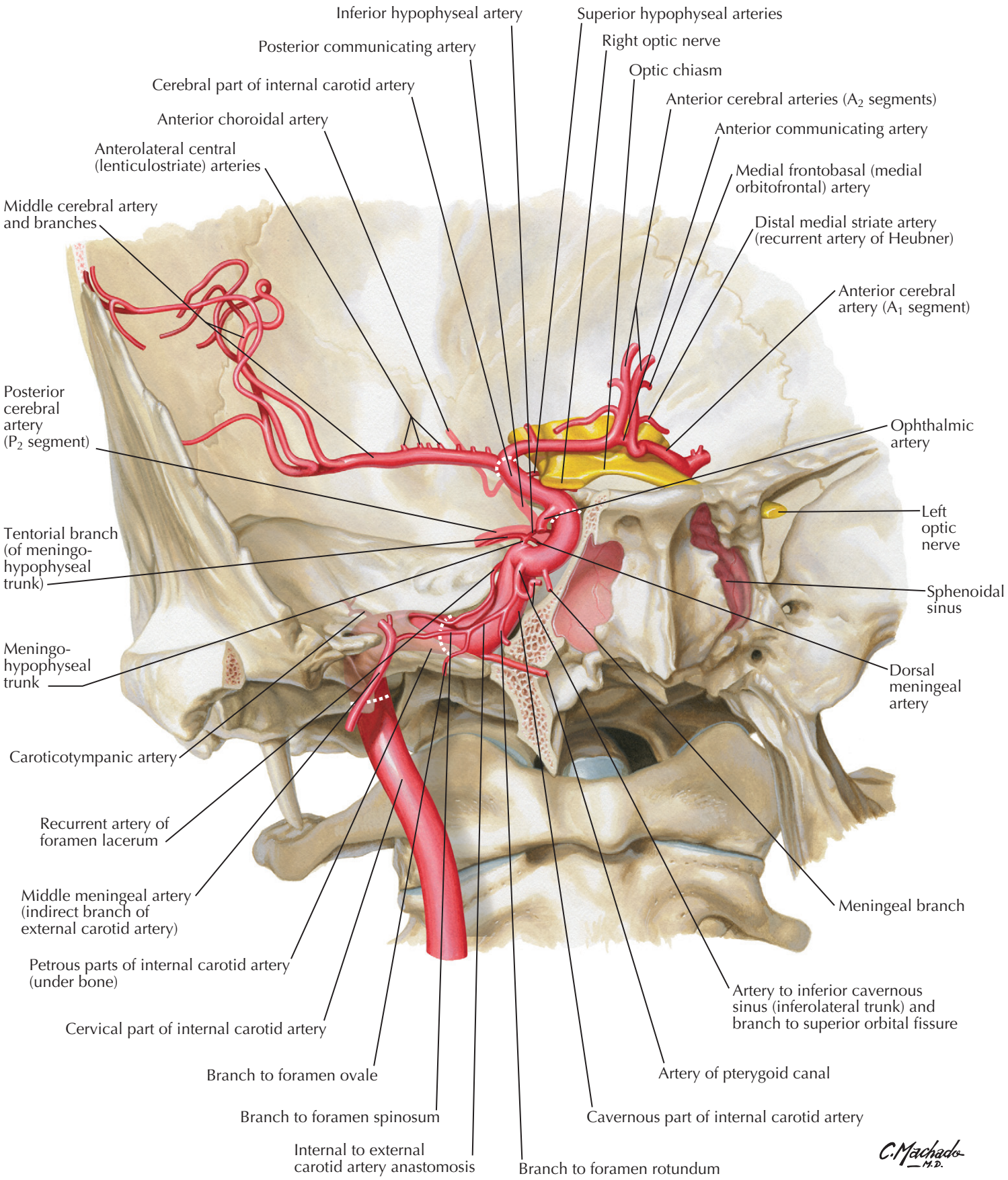
Taste Pathways: Schema

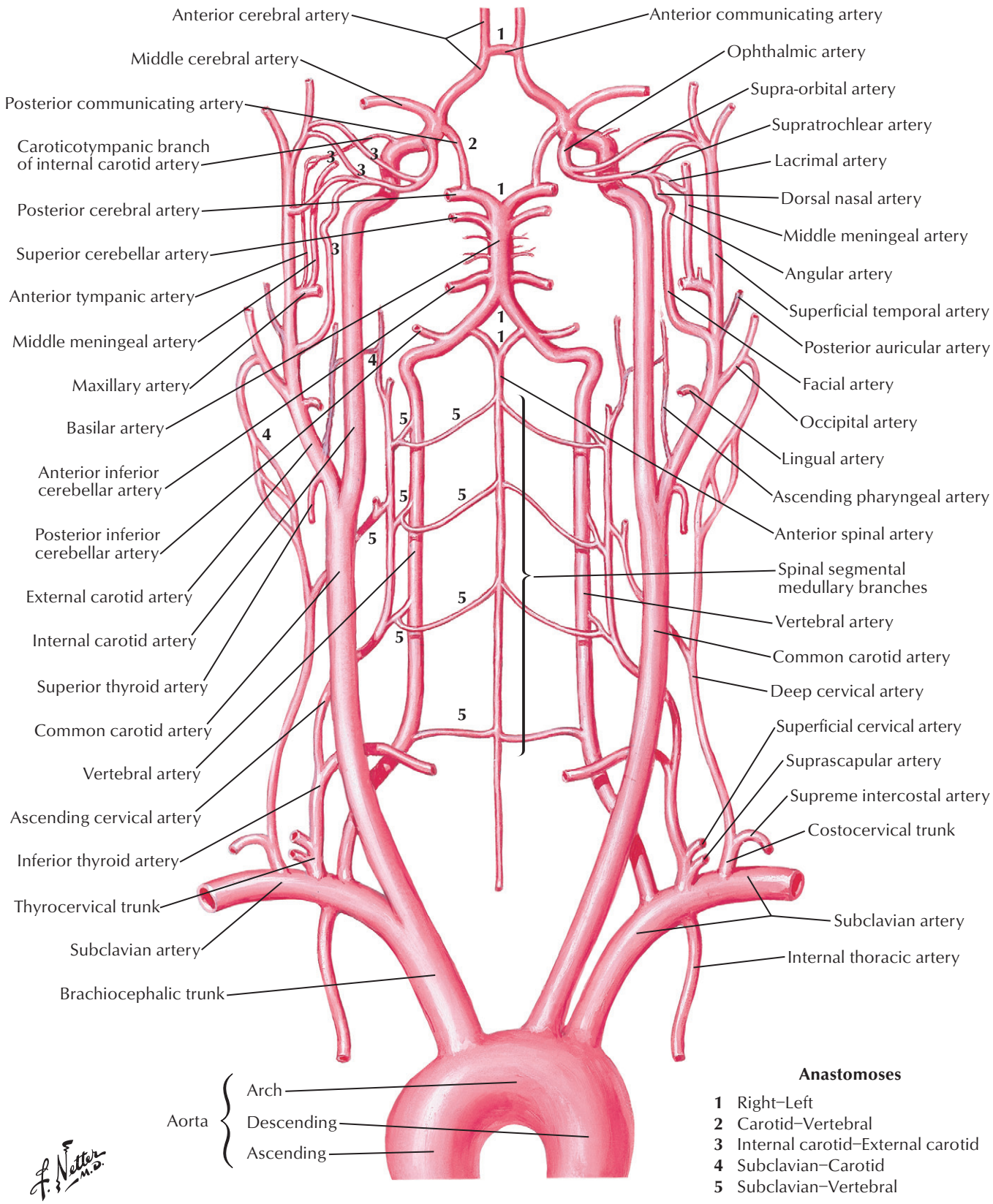
See also Plates 124, 126, 127

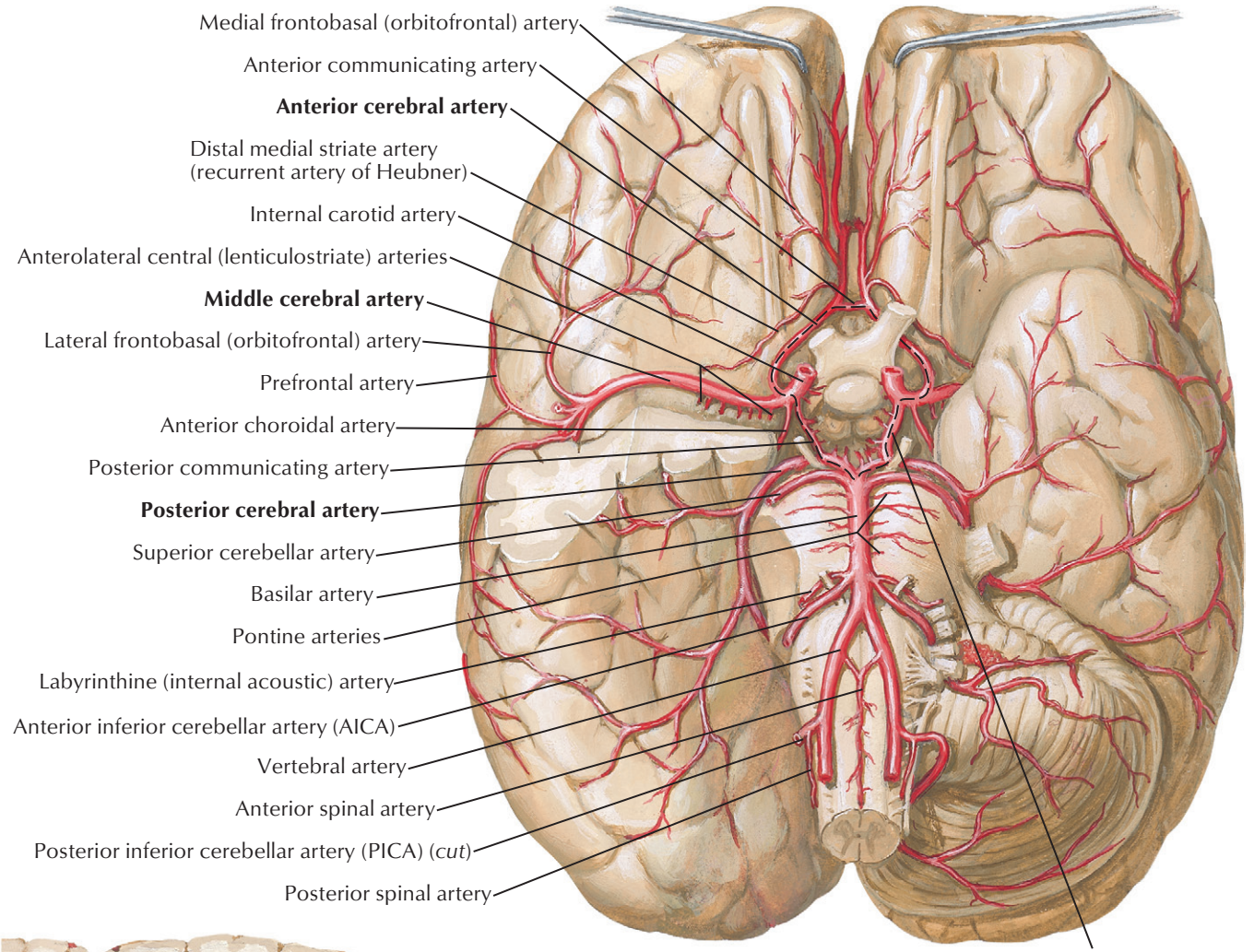


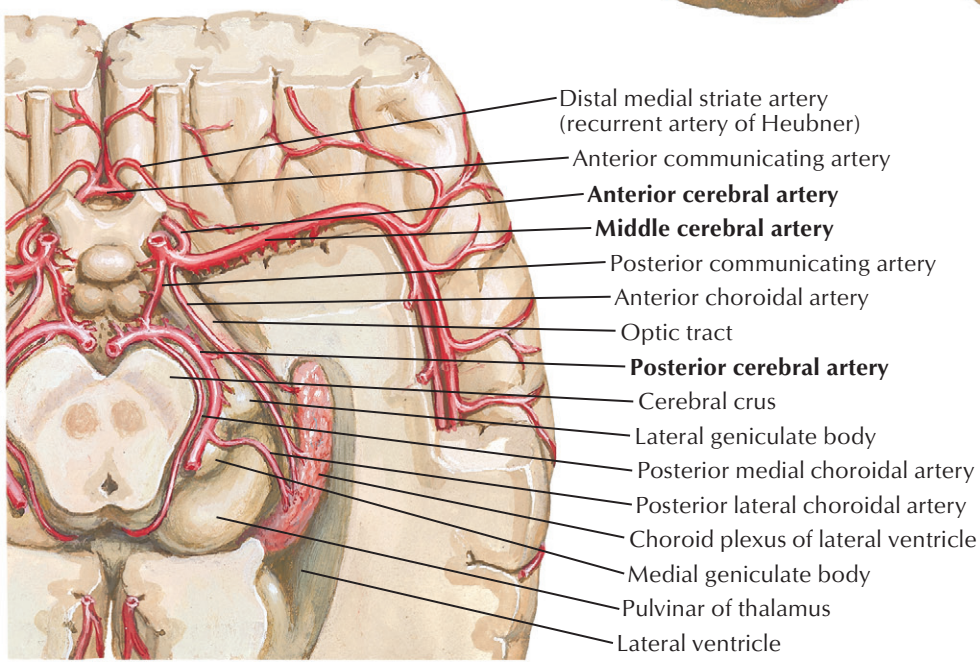

Left middle meningeal artery
Middle cerebral artery
Posterior cerebral artery
Anterior cerebral artery
Superior cerebellar artery
Anterior communicating artery
Basilar artery
Ophthalmic artery
Left labyrinthine (internal acoustic) artery
Posterior communicating artery
Mastoid branch of left occipital artery
Cavernous sinus
Anterior inferior cerebellar artery
Middle meningeal artery
Posterior meningeal branch of left ascending pharyngeal artery
Posterior inferior cerebellar artery
Left and right vertebral arteries (intracranial part)
Maxillary artery
Superficial temporal artery
Posterior meningeal branch of vertebral artery
External carotid artery
Anterior meningeal branch of vertebral artery
Facial artery
Posterior auricular artery
Lingual artery
Occipital artery
Ascending pharyngeal artery
Internal carotid artery
Superior laryngeal artery
Carotid sinus
Superior thyroid artery
Carotid body
Common carotid artery
Vertebral artery (cervical part)
Inferior thyroid artery
Transverse process of C6
Thyrocervical trunk
Deep cervical artery
Brachiocephalic trunk
Supreme intercostal artery
Costocervical trunk
Subclavian artery
F. Netter M.D.

Internal Carotid Artery in Petrous Part of Temporal Bone




Anterior cerebral artery
Middle cerebral artery
Posterior communicating artery
Caroticotympanic branch of internal carotid artery
Posterior cerebral artery
Superior cerebellar artery
Anterior tympanic artery
Middle meningeal artery
Maxillary artery
Basilar artery
Anterior inferior cerebellar artery
Posterior inferior cerebellar artery
External carotid artery
Internal carotid artery
Superior thyroid artery
Common carotid artery
Vertebral artery
Ascending cervical artery
Inferior thyroid artery
Thyrocervical trunk
Subclavian artery
Brachiocephalic trunk
Aorta
Arch
Descending
Ascending
Anterior communicating artery
Ophthalmic artery
Supra-orbital artery
Supratrochlear artery
Lacrimal artery
Dorsal nasal artery
Middle meningeal artery
Angular artery
Superficial temporal artery
Posterior auricular artery
Facial artery
Occipital artery
Lingual artery
Ascending pharyngeal artery
Anterior spinal artery
Spinal segmental medullary branches
Vertebral artery
Common carotid artery
Deep cervical artery
Superficial cervical artery
Suprascapular artery
Supreme intercostal artery
Costocervical trunk
Subclavian artery
Internal thoracic artery
1
2
3
4
5
Anastomoses
1 Right–Left
2 Carotid–Vertebral
3 Internal carotid–External carotid
4 Subclavian–Carotid
5 Subclavian–Vertebral

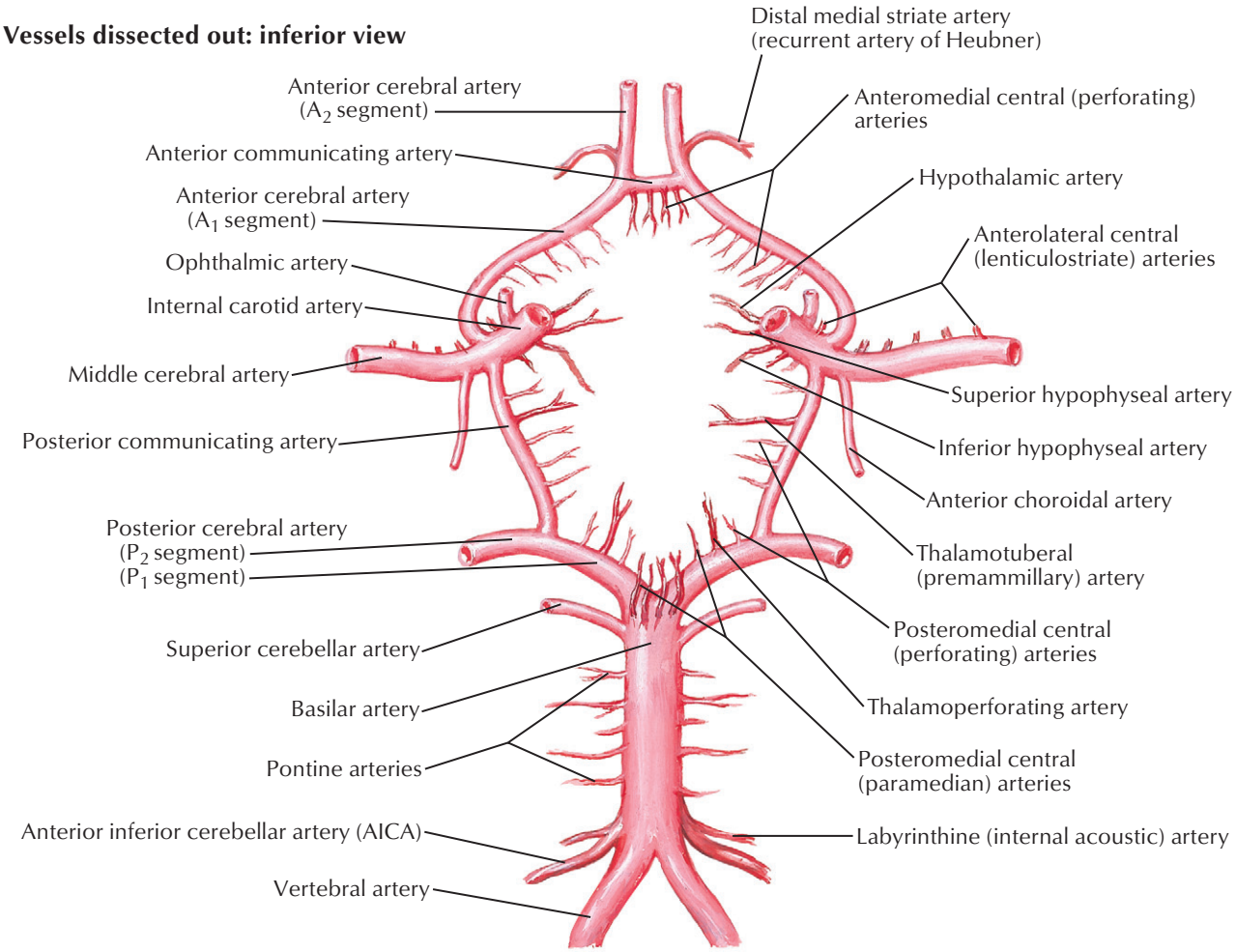

Medial frontobasal (orbitofrontal) artery
Anterior communicating artery
Anterior cerebral artery
Distal medial striate artery (recurrent artery of Heubner)
Internal carotid artery
Anterolateral central (lenticulostriate) arteries
Middle cerebral artery
Lateral frontobasal (orbitofrontal) artery
Prefrontal artery
Anterior choroidal artery
Posterior communicating artery
Posterior cerebral artery
Superior cerebellar artery
Basilar artery
Pontine arteries
Labyrinthine (internal acoustic) artery
Anterior inferior cerebellar artery (AICA)
Vertebral artery
Anterior spinal artery
Posterior inferior cerebellar artery (PICA) (cut)
Posterior spinal artery
Cerebral arterial circle (of Willis) (broken line)


Distal medial striate artery (recurrent artery of Heubner)
Anterior communicating artery
Anterior cerebral artery
Middle cerebral artery
Posterior communicating artery
Anterior choroidal artery
Optic tract
Posterior cerebral artery
Cerebral crus
Lateral geniculate body
Posterior medial choroidal artery
Posterior lateral choroidal artery
Choroid plexus of lateral ventricle
Medial geniculate body
Pulvinar of thalamus
Lateral ventricle

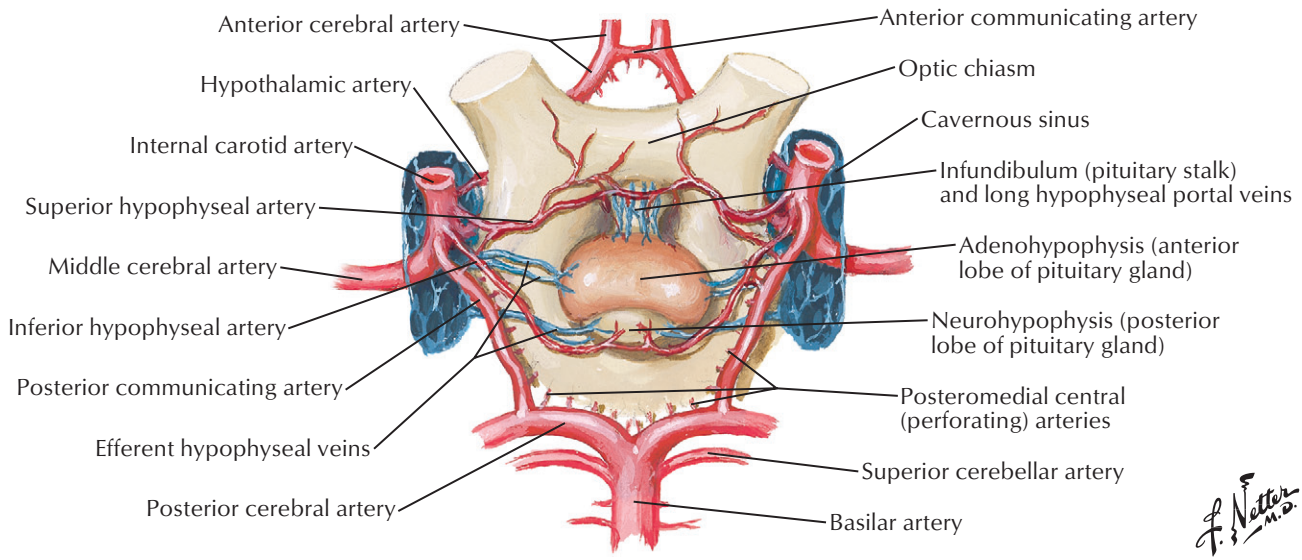
Cerebral Arterial Circle (of Willis)

For hypophyseal arteries see **Plate 149**

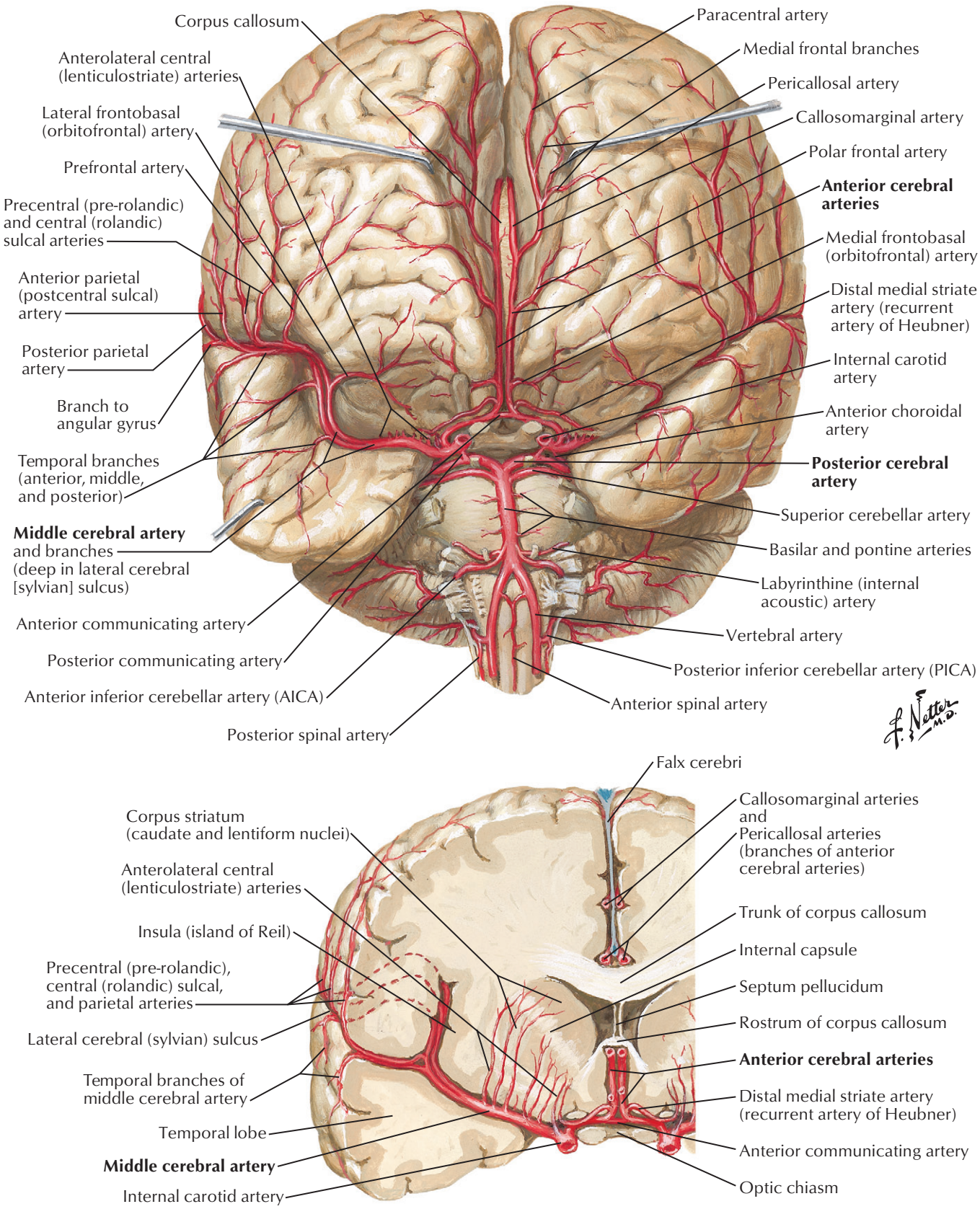
Vessels dissected out: inferior view

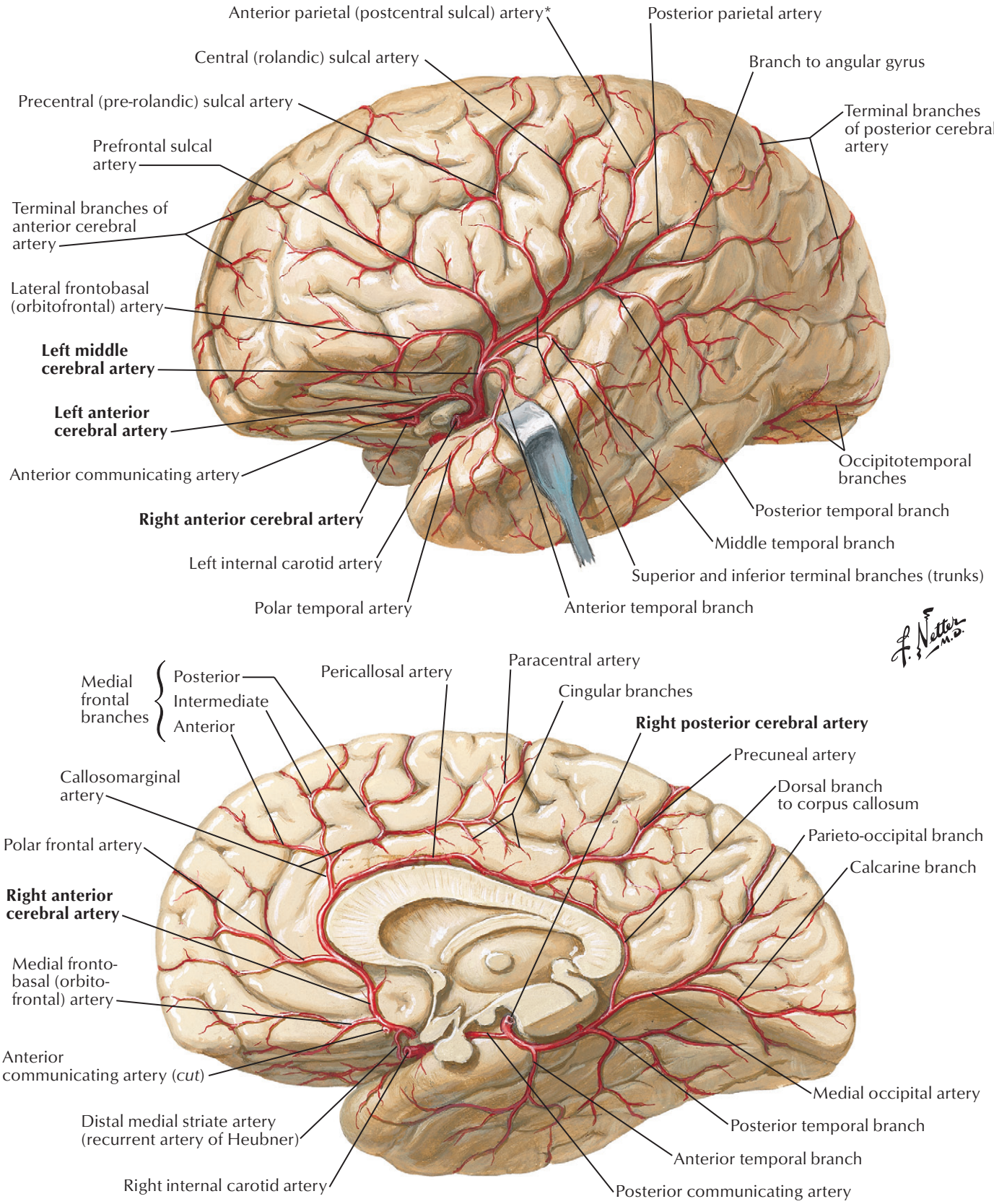


Vessels in situ: inferior view

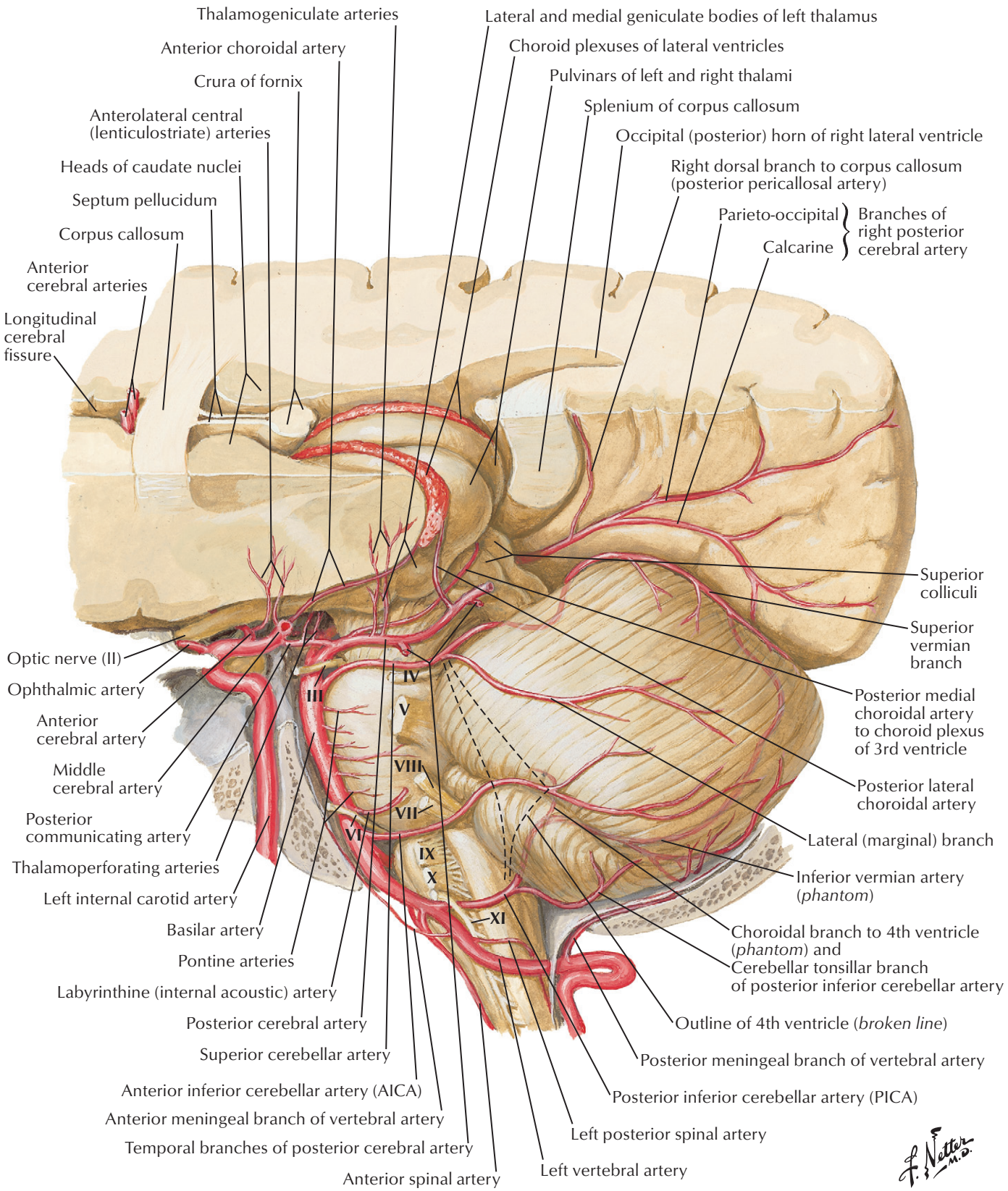


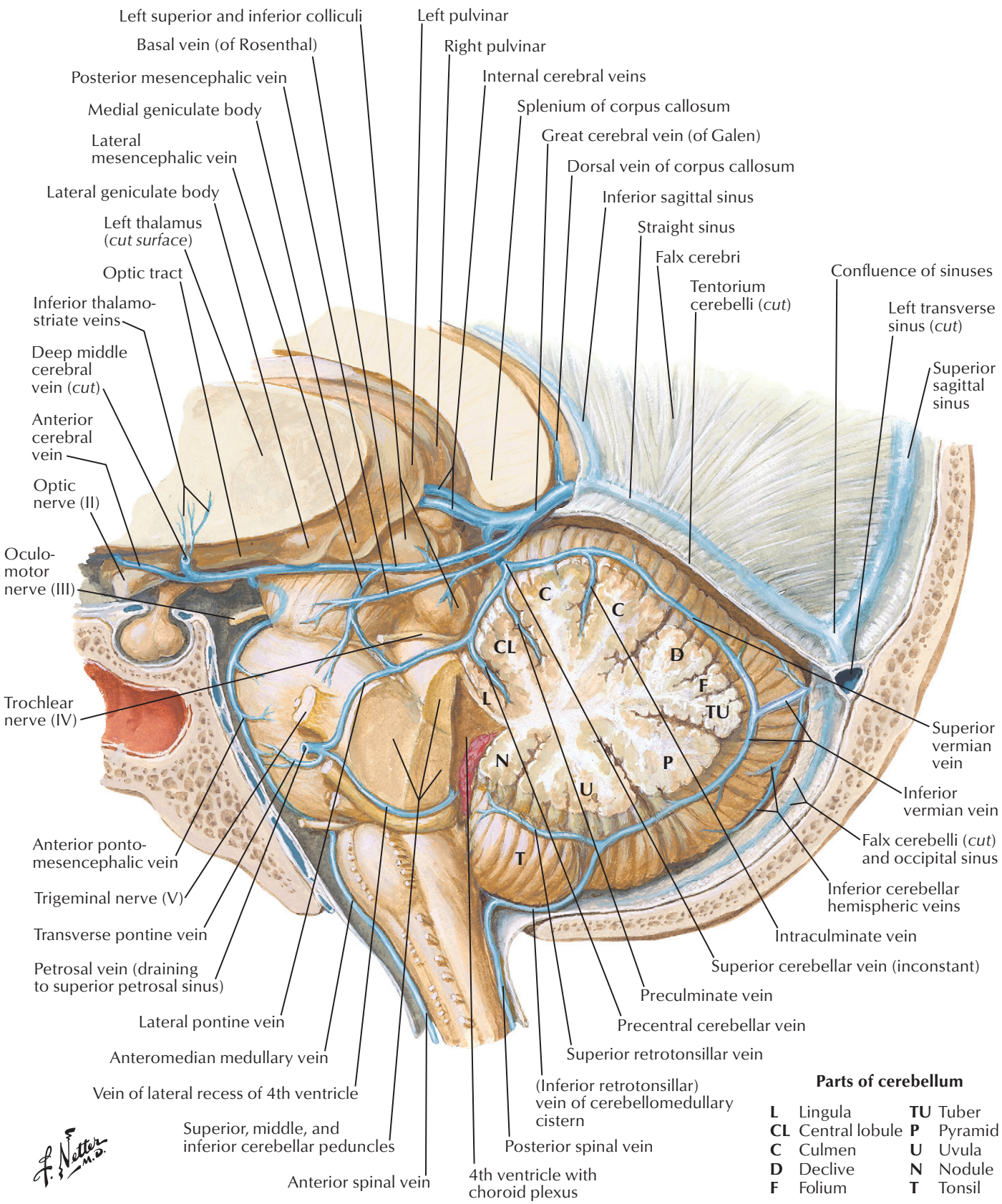
Arteries of Brain: Frontal View and Section





*Note: Anterior parietal (postcentral sulcal) artery also occurs as separate anterior parietal and postcentral sulcal arteries.


Thalamogeniculate arteries
Anterior choroidal artery
Crura of fornix
Anterolateral central (lenticulostriate) arteries
Heads of caudate nuclei
Septum pellucidum
Corpus callosum
Anterior cerebral arteries
Longitudinal cerebral fissure
Lateral and medial geniculate bodies of left thalamus
Choroid plexuses of lateral ventricles
Pulvinars of left and right thalami
Splenium of corpus callosum
Occipital (posterior) horn of right lateral ventricle
Right dorsal branch to corpus callosum (posterior pericallosal artery)
Parieto-occipital
Calcarine
Branches of right posterior cerebral artery
Superior colliculi
Superior vermian branch
Posterior medial choroidal artery to choroid plexus of 3rd ventricle
Posterior lateral choroidal artery
Lateral (marginal) branch
Inferior vermian artery (phantom)
Choroidal branch to 4th ventricle (phantom) and
Cerebellar tonsillar branch of posterior inferior cerebellar artery
Outline of 4th ventricle (broken line)
Posterior meningeal branch of vertebral artery
Posterior inferior cerebellar artery (PICA)
Left posterior spinal artery
Left vertebral artery
Optic nerve (II)
Ophthalmic artery
Anterior cerebral artery
Middle cerebral artery
Posterior communicating artery
Thalamoperforating arteries
Left internal carotid artery
Basilar artery
Pontine arteries
Labyrinthine (internal acoustic) artery
Posterior cerebral artery
Superior cerebellar artery
Anterior inferior cerebellar artery (AICA)
Anterior meningeal branch of vertebral artery
Temporal branches of posterior cerebral artery
Anterior spinal artery
III
IV
V
VI
VII
VIII
IX
X
XI

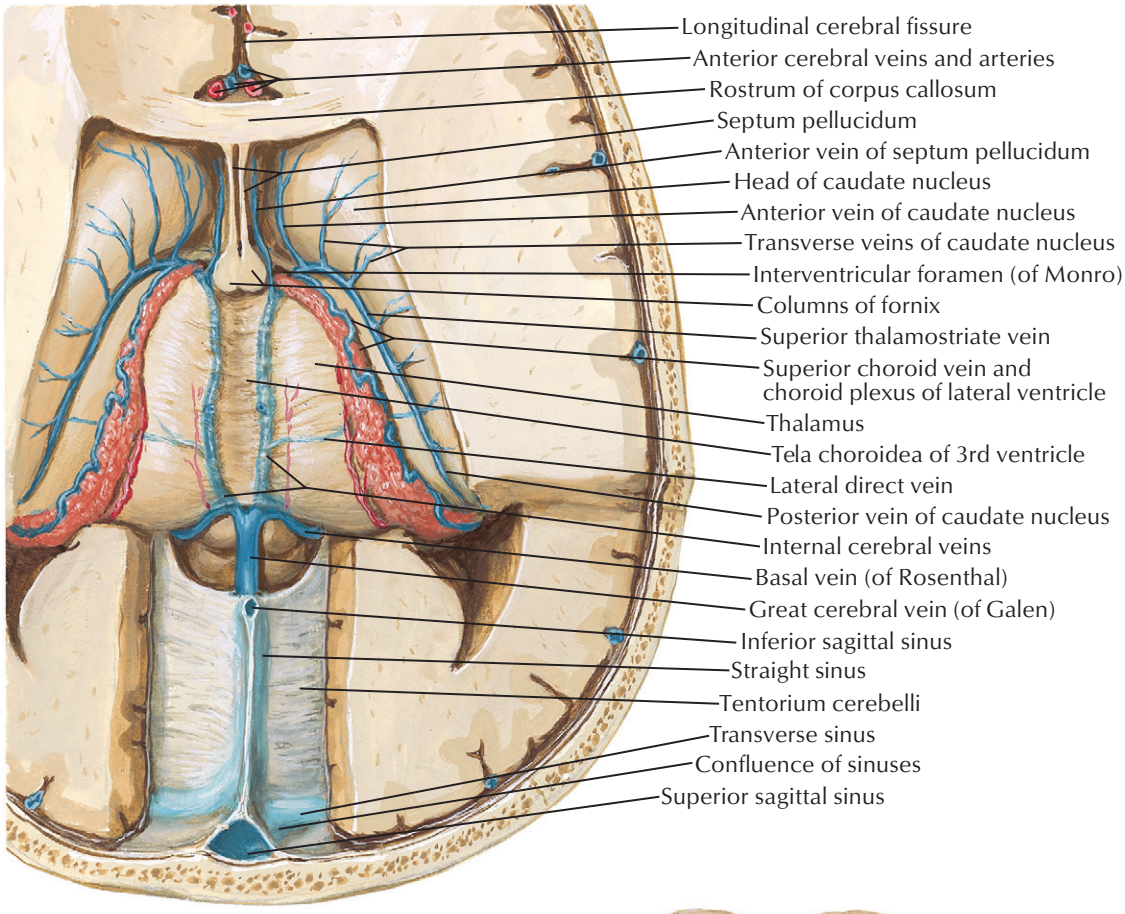


Parts of cerebellum

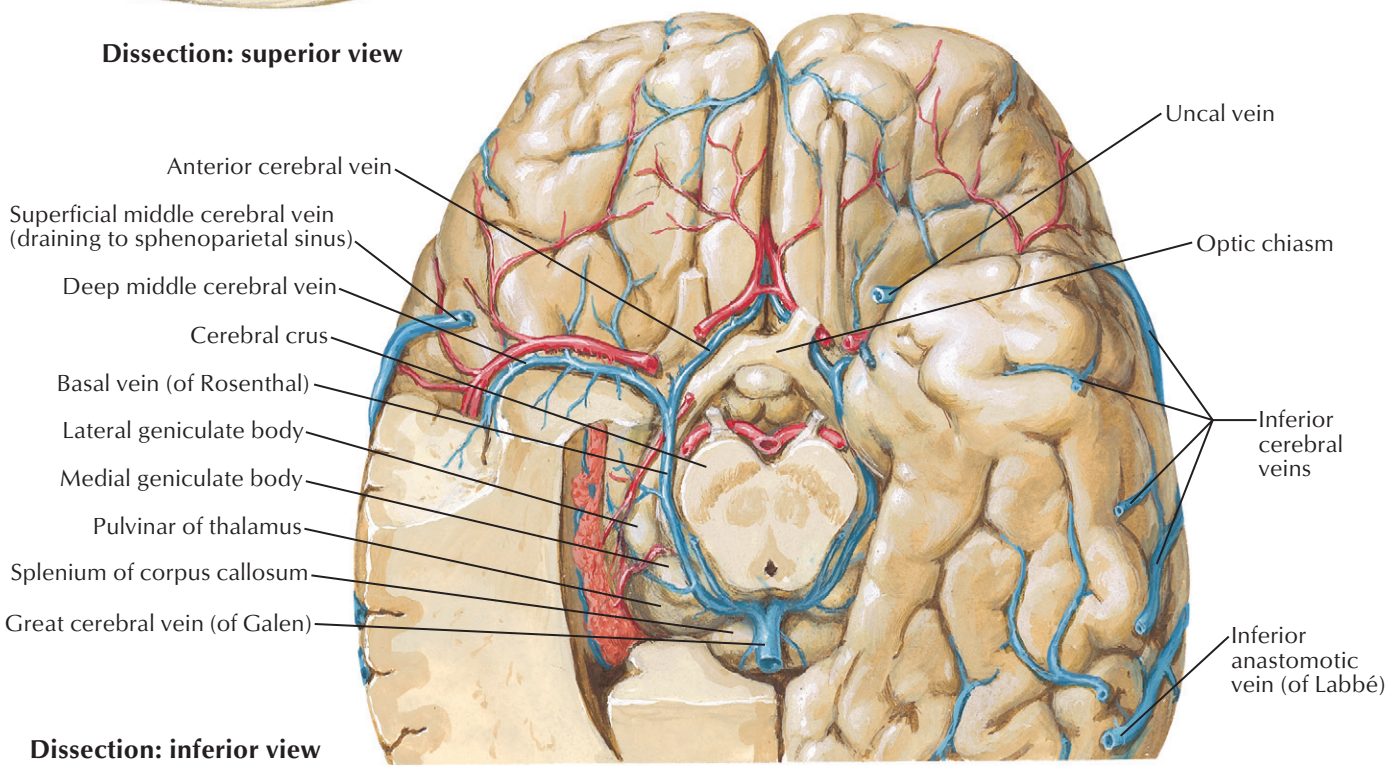
L	Lingula	**TU**	Tuber
CL	Central lobule	**P**	Pyramid
C	Culmen	**U**	Uvula
D	Declive	**N**	Nodule
F	Folium	**T**	Tonsil

Deep Veins of Brain

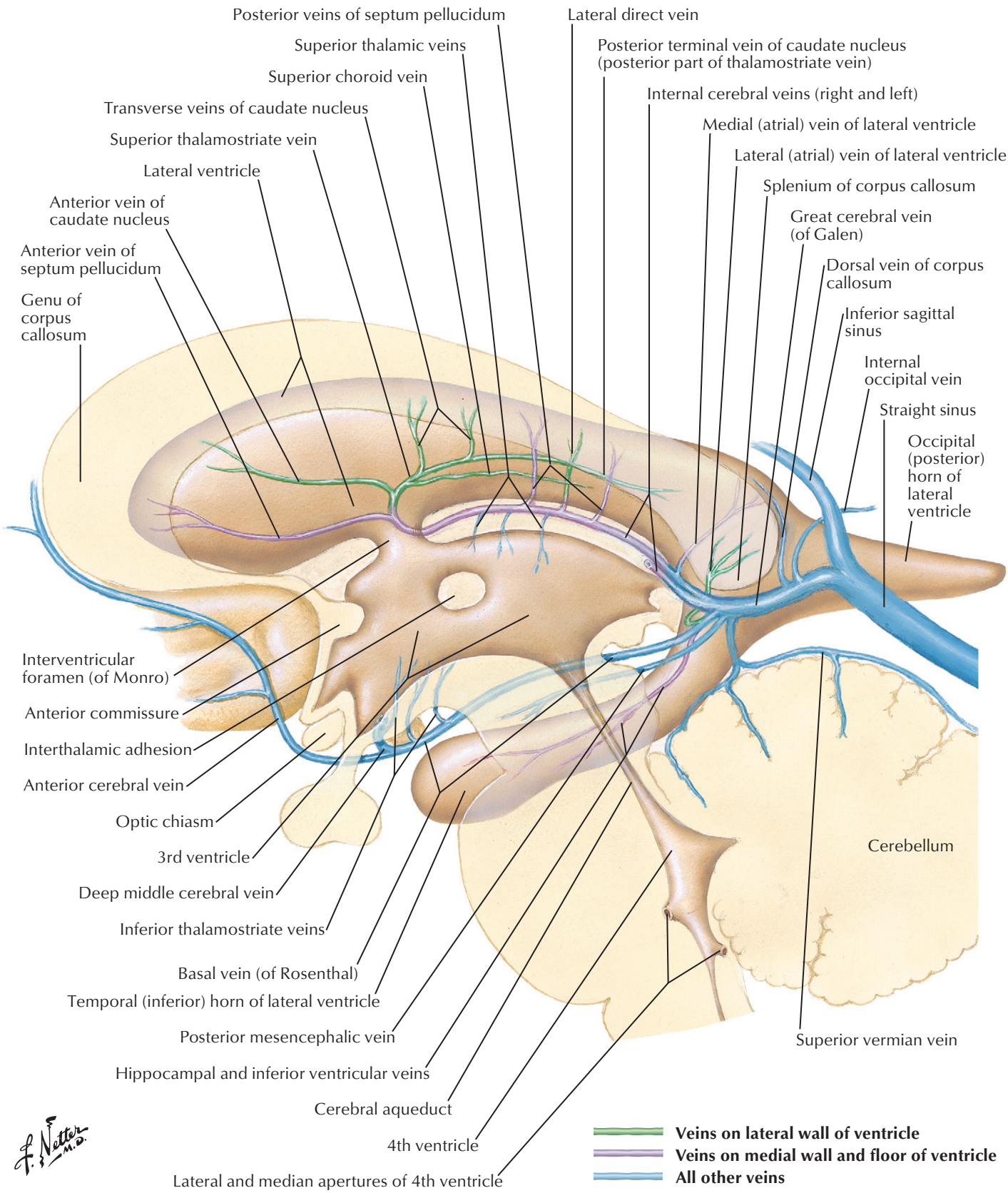
For superficial veins of brain see **Plate 103**



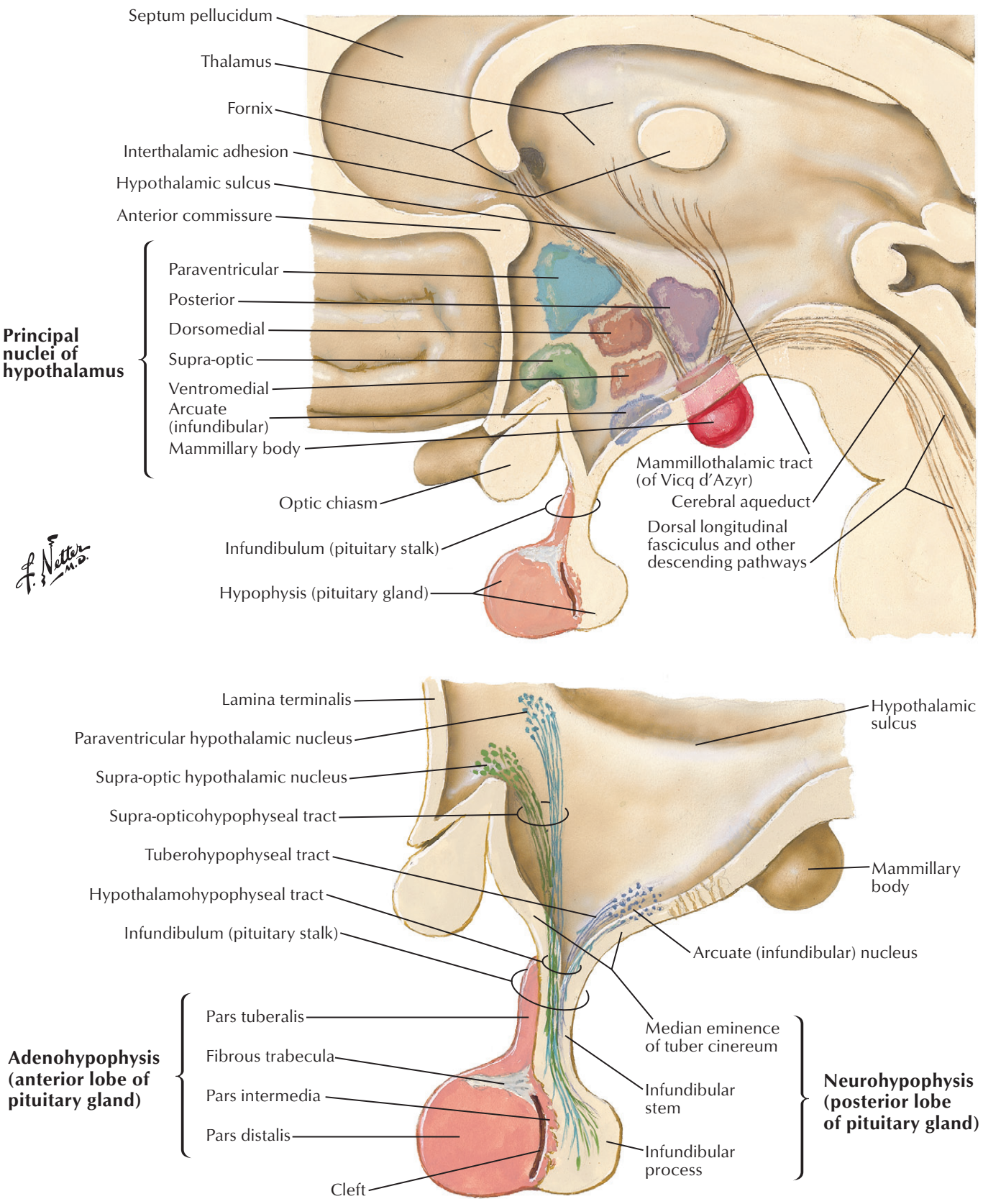
Dissection: superior view



Dissection: inferior view

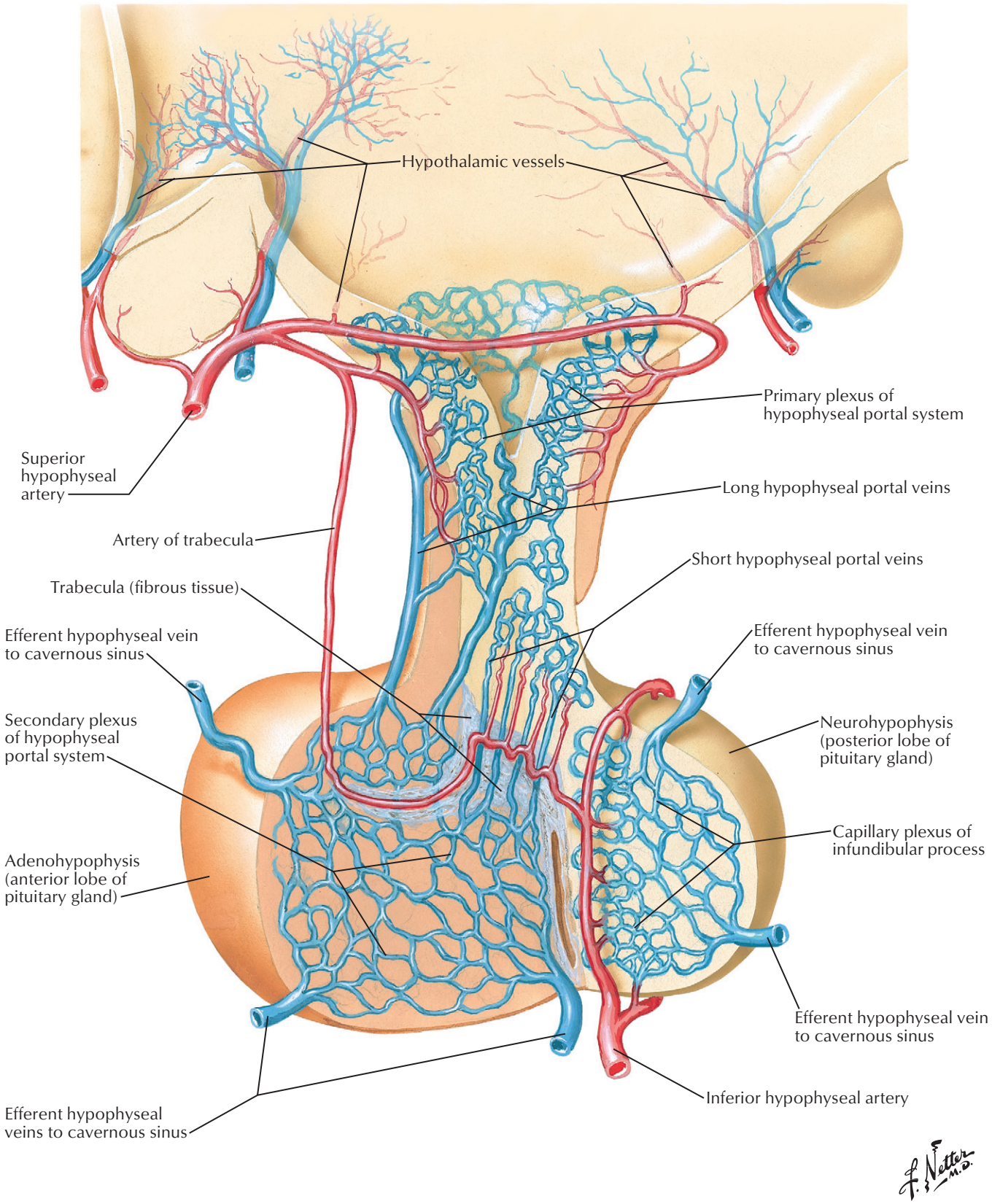

Posterior veins of septum pellucidum
Superior thalamic veins
Superior choroid vein
Transverse veins of caudate nucleus
Superior thalamostriate vein
Lateral ventricle
Anterior vein of caudate nucleus
Anterior vein of septum pellucidum
Genu of corpus callosum
Lateral direct vein
Posterior terminal vein of caudate nucleus (posterior part of thalamostriate vein)
Internal cerebral veins (right and left)
Medial (atrial) vein of lateral ventricle
Lateral (atrial) vein of lateral ventricle
Splenium of corpus callosum
Great cerebral vein (of Galen)
Dorsal vein of corpus callosum
Inferior sagittal sinus
Internal occipital vein
Straight sinus
Occipital (posterior) horn of lateral ventricle
Interventricular foramen (of Monro)
Anterior commissure
Interthalamic adhesion
Anterior cerebral vein
Optic chiasm
3rd ventricle
Deep middle cerebral vein
Inferior thalamostriate veins
Basal vein (of Rosenthal)
Temporal (inferior) horn of lateral ventricle
Posterior mesencephalic vein
Hippocampal and inferior ventricular veins
Cerebral aqueduct
4th ventricle
Lateral and median apertures of 4th ventricle
Cerebellum
Superior vermian vein
Veins on lateral wall of ventricle
Veins on medial wall and floor of ventricle
All other veins

See also Plates 107, 108

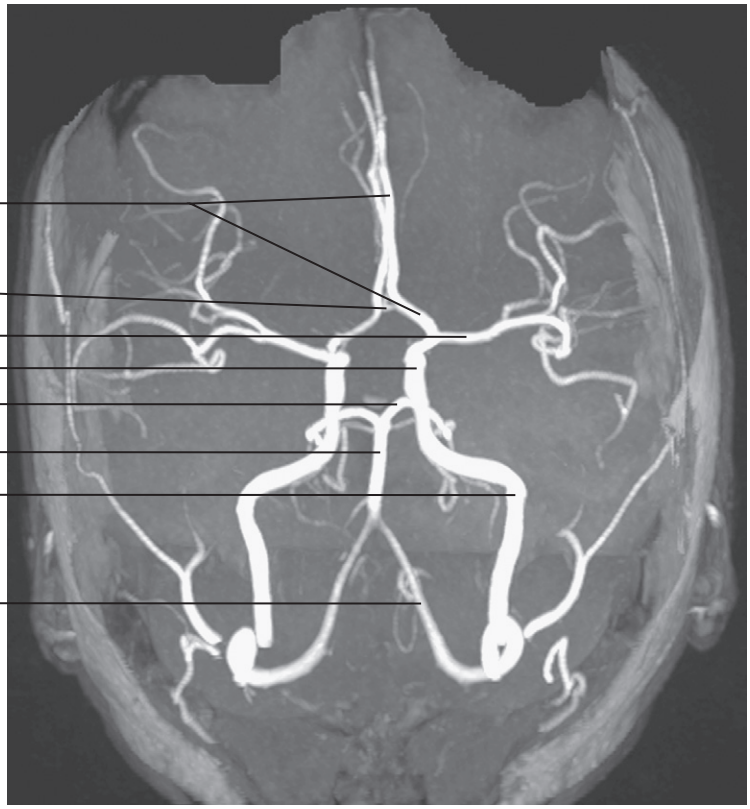


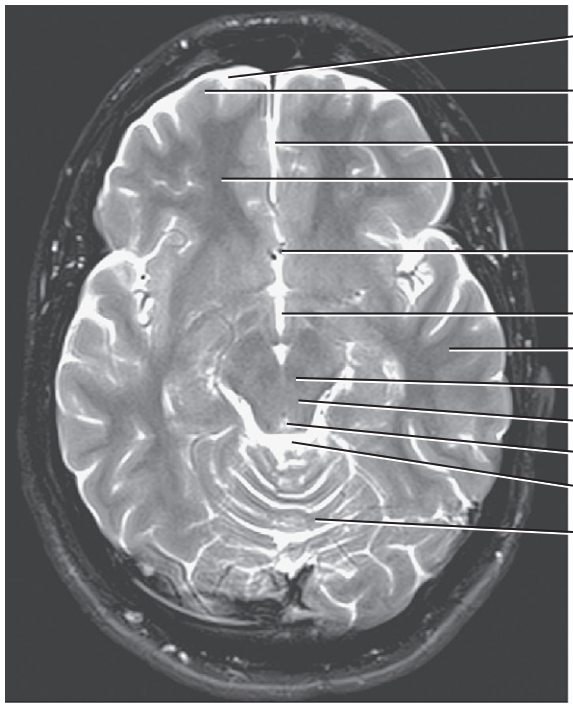
Arteries and Veins of Hypothalamus and Hypophysis

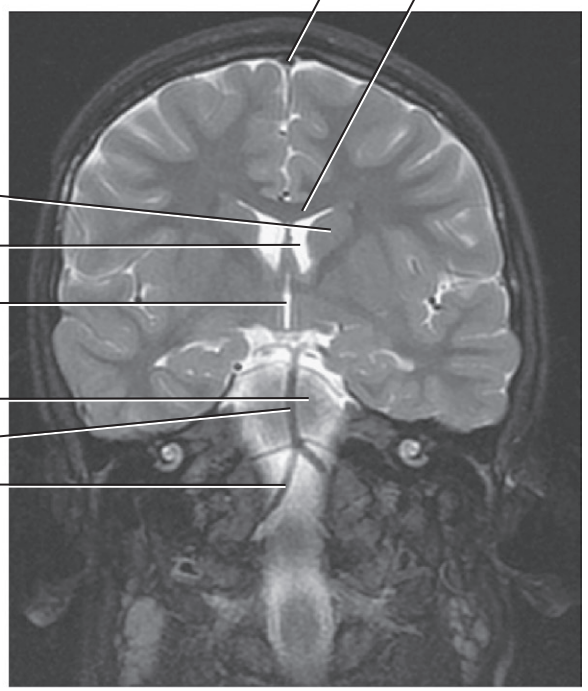
See also Plate 141

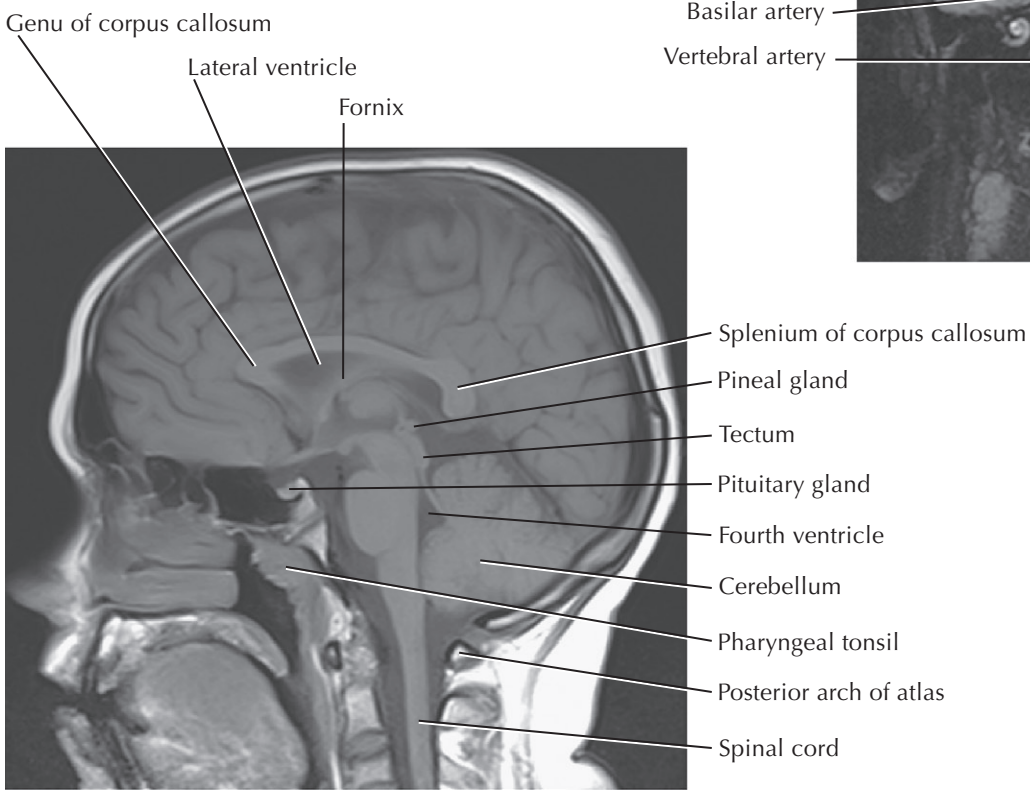



Bridging vein
Superior sagittal sinus
Internal cerebral vein
Great cerebral vein (of Galen)
Straight sinus
Transverse sinus
Sigmoid sinus
Internal jugular vein


Anterior cerebral artery
Anterior communicating artery
Middle cerebral artery
Posterior communicating artery
Posterior cerebral artery
Basilar artery
Internal carotid artery
Vertebral artery


Subarachnoid space
Gray matter
Longitudinal fissure
White matter
Anterior cerebral artery
Third ventricle
Temporal lobe
Red nucleus
Midbrain
Cerebral aqueduct
Quadrigeminal cistern
Cerebellum


Superior sagittal sinus
Corpus callosum
Head of caudate
Lateral ventricle
Third ventricle
Pons
Basilar artery
Vertebral artery


Genu of corpus callosum
Lateral ventricle
Fornix
Splenium of corpus callosum
Pineal gland
Tectum
Pituitary gland
Fourth ventricle
Cerebellum
Pharyngeal tonsil
Posterior arch of atlas
Spinal cord

Muscle Tables

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Auricularis anterior	Temporal fascia, epicranial aponeurosis	Anterior part of medial surface of helix of ear	Posterior auricular and temporal branches of facial nerve	Elevates and draws ear forward	Auricular branch of posterior auricular artery, parietal branch of superficial temporal artery	External ear
Auricularis posterior	Base of mastoid process	Lower part of cranial surface of auricle	Posterior auricular and temporal branches of facial nerve	Retracts and elevates ear	Auricular branch of posterior auricular artery, parietal branch of superficial temporal artery	External ear
Auricularis superior	Temporal fascia, epicranial aponeurosis	Upper part of medial surface of auricle	Posterior auricular and temporal branches of facial nerve	Retracts and elevates ear	Auricular branch of posterior auricular artery, parietal branch of superficial temporal artery	External ear
Buccinator	Posterior portion of alveolar process of maxilla and mandible opposite sockets of molar teeth, anterior border of pterygomandibular raphe	Angle of mouth	Buccal branches of facial nerve	Compresses cheeks, expels air between lips, aids in mastication	Muscular branches of facial artery, buccal branch of maxillary artery	Facial expression
Ciliary	Corneoscleral junction	Ciliary body	Parasympathetic fibers via short ciliary nerves (CN III)	Constricts ciliary body and lens rounds up (accommodation)	Ophthalmic artery	Intrinsic eye
Corrugator supercilii	Medial part of supra-orbital margin	Skin of medial half of eyebrow	Zygomatic and temporal branches of facial nerve	Draws eyebrows downward and medially, produces wrinkles in frowning	Zygomatic and anterior branches of superficial temporal artery	Facial expression
Cricothyroid	Anterior cricoid cartilage	Inferior border of thyroid cartilage and its inferior horn	External branch of superior laryngeal nerve	Lengthens and tenses vocal ligaments	Superior and inferior thyroid arteries	Laryngeal
Depressor anguli oris	Continuous with platysma on oblique line of mandible	Angle of mouth into orbicularis and skin	Mandibular and buccal branches of facial nerve	Depresses angle of mouth	Inferior labial branch of facial artery	Facial expression
Depressor labii inferioris	Lateral surface of mandible between symphysis and mental foramen deep to depressor anguli oris	Skin to lower lip, mingling with orbicularis oris, medial fibers joining those of opposite side	Mandibular and buccal branches of facial nerve	Depresses lower lip and draws it lateralward	Inferior labial branch of facial artery	Facial expression
Depressor septi nasi	Incisive fossa of maxilla	Septum and posterior part of ala of nose	Zygomatic and buccal branches of facial nerve	Narrows nostril, draws septum downward	Superior labial branch of facial artery	Facial expression
Digastric	*Anterior belly:* digastric fossa of mandible *Posterior belly*: mastoid notch of temporal bone	Intermediate tendon attached to body of hyoid	*Anterior belly:* nerve to mylohyoid *Posterior belly:* facial nerve	Raises hyoid bone and base of tongue, steadies hyoid bone, opens mouth by lowering mandible	*Anterior belly*: branches of submental artery *Posterior belly:* muscular branches of posterior auricular artery, muscular branches of occipital artery	Suprahyoid
Dilator pupillae	Radial fibers in iris	Blends with sphincter pupillae fibers	Sympathetic fibers from SCG	Dilates pupil	Ophthalmic artery	Intrinsic eye
Frontal belly of occipitofrontalis	Epicranial aponeurosis at level of coronal suture	Skin of frontal region, epicranial aponeurosis	Temporal branches of facial nerve	Wrinkles forehead skin, raises eyebrows	Frontal branch of superficial temporal artery	Facial expression

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

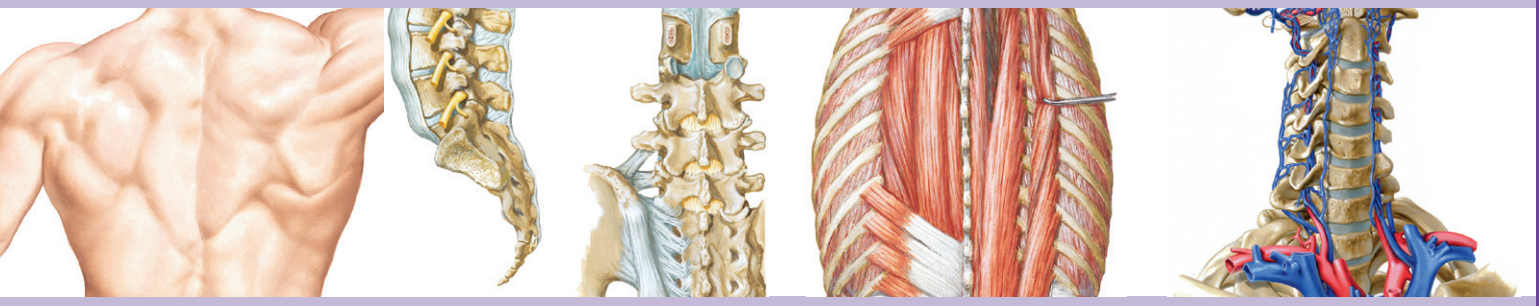
MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Genioglossus	Mental spine of mandible	Dorsum of tongue, hyoid bone	Hypoglossal nerve (CN XII)	Depresses and protrudes tongue	Sublingual and submental arteries	Extrinsic tongue
Geniohyoid	Inferior genial tubercle on back of symphysis of mandible	Anterior surface of body of hyoid bone	Branch of C1 through hypoglossal nerve (CN XII)	Elevates hyoid bone and depresses mandible	Sublingual branch of lingual artery	Suprahyoid
Hyoglossus	Body and greater horn of hyoid bone	Lateral and inferior aspect of tongue	Hypoglossal nerve (CN XII)	Depresses and retracts tongue	Sublingual and submental arteries	Extrinsic tongue
Inferior longitudinal muscle of tongue	Under surface of tongue between genioglossus and hyoglossus	Tip of tongue blending with styloglossus	Hypoglossal nerve (CN XII)	Shortens tongue, turns tip and sides downward	Deep lingual branch of lingual artery, branches from facial artery	Intrinsic tongue
Inferior oblique	Anterior floor of orbit lateral to nasolacrimal canal	Lateral sclera deep to lateral rectus	Oculomotor nerve (CN III), inferior division	Abducts, elevates, and laterally rotates eyeball	Ophthalmic artery	Extra-ocular
Inferior pharyngeal constrictor	Oblique line of thyroid cartilage and cricoid cartilage	Median raphe of pharynx	Vagus nerve via pharyngeal plexus	Constricts wall of pharynx during swallowing	Ascending pharyngeal artery, branches of superior thyroid artery	Circular pharyngeal
Inferior rectus	Common tendinous ring	Inferior aspect of eyeball, posterior to corneoscleral junction	Oculomotor nerve (CN III), inferior division	Depresses, adducts, and laterally rotates eyeball	Ophthalmic artery	Extra-ocular
Lateral crico-arytenoid	Arch of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Adducts vocal folds	Superior and inferior thyroid arteries	Laryngeal
Lateral pterygoid	*Superior head:* infratemporal surface of greater wing of sphenoid *Inferior head:* lateral pterygoid plate	Pterygoid fovea, capsule of temporomandibular joint, articular disc	Mandibular nerve ($CN V_3$), muscular branches from anterior division	*Bilaterally:* protrude mandible *Unilaterally and alternately:* produces side-to-side grinding	Muscular branches of maxillary artery	Mastication
Lateral rectus	Common tendinous ring	Lateral aspect of eyeball, posterior to corneoscleral junction	Abducent nerve (CN VI)	Abducts eyeball	Ophthalmic artery	Extra-ocular
Levator anguli oris	Canine fossa of maxilla immediately below infra-orbital foramen and under cover of zygomatic head of levator labii superioris	Angle of mouth; fibers intermingle with orbicularis oris, depressor anguli oris, zygomaticus	Zygomatic and buccal branches of facial nerve	Elevates angle of mouth	Superior labial branch of facial artery	Facial expression
Levator labii superioris alaeque nasi	*Angular head:* upper part of frontal process of maxilla *Infra-orbital head:* orbit above infra-orbital foramen *Zygomatic head:* malar surface of zygomatic bone	*Angular head:* into greater alar cartilage, skin of nose, lateral upper lip *Infra-orbital head:* into muscular substance of upper lip between angular head and caninus *Zygomatic head:* into skin of nasolabial groove and upper lip	Zygomatic and buccal branches of facial nerve	*Angular head:* elevates upper lip and dilates nostril *Infra-orbital head:* raises angle of mouth *Zygomatic head*: elevates upper lip laterally	Superior labial branch and angular branches of facial artery	Facial expression

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Levator labii superioris	Maxilla above infra-orbital foramen	Skin of upper lip	Zygomatic and buccal branches of facial nerve	Elevates upper lip, dilates nares	Superior labial artery and angular branches of facial artery	Facial expression
Levator palpebrae superioris	Lesser wing of sphenoid, anterior to optic canal	Superior tarsal plate	Oculomotor nerve (CN III), superior division	Raises upper eyelid	Ophthalmic artery	Extra-ocular; eyelid
Levator veli palatini	Temporal bone (petrous portion)	Palatine aponeurosis	Vagus nerve via pharyngeal plexus	Elevates soft palate during swallowing	Ascending palatine artery branch of facial artery, descending palatine artery branch of maxillary artery	Palatal
Longus capitis	Anterior tubercles of transverse processes of C3–C6	Inferior surface of basilar part of occipital bone	Ventral rami of cervical nerves (C1–C4)	Flexes and assists in rotating cervical vertebrae and head	Ascending cervical branch of inferior thyroid artery, ascending pharyngeal artery, muscular branches of vertebral artery	Prevertebral
Longus colli	*Vertical portion:* C5–T3 vertebrae *Inferior oblique portion:* T1–T3 vertebrae *Superior oblique portion*: anterior tubercles of transverse processes of C3–C5 vertebrae	*Vertical portion:* into C2–C4 vertebrae *Inferior oblique portion* on anterior tubercles of transverse processes of C5–C6 vertebrae *Superior oblique portion:* tubercle of anterior arch of atlas	Ventral primary rami of cervical nerves (C2–C8)	*Bilaterally*: flex and assist in rotating cervical vertebrae and head *Unilaterally:* flexes vertebral column laterally	Prevertebral branches of ascending pharyngeal artery, muscular branches of ascending cervical and vertebral arteries	Prevertebral
Masseter	Zygomatic arch	Ramus of mandible, coronoid process	Mandibular nerve (CN V_3), via masseteric nerve	Elevates and protrudes mandible; deep fibers retrude it	Transverse facial artery; masseteric branch of maxillary and facial arteries	Mastication
Medial pterygoid	Medial surface of lateral plate of pterygoid, pyramidal process of palatine bone, maxillary tuberosity	Medial surface of ramus and angle of mandible inferior to mandibular foramen	Mandibular nerve (V_3), nerve to medial pterygoid	*Bilaterally:* protrude and elevate mandible *Unilaterally and alternately:* produces side-to-side movements	Facial and maxillary arteries	Mastication
Medial rectus	Common tendinous ring	Medial aspect of eyeball, posterior to corneoscleral junction	Oculomotor nerve (CN III), inferior division	Adducts eyeball	Ophthalmic artery	Extra-ocular
Mentalis	Incisive fossa of mandible	Skin of chin	Mandibular branch of facial nerve	Raises and protrudes lower lip	Inferior labial branch of facial artery	Facial expression
Middle pharyngeal constrictor	Stylohyoid ligament and horns of hyoid bone	Median raphe of pharynx	Vagus nerve via pharyngeal plexus	Constricts wall of pharynx during swallowing	Ascending pharyngeal artery, ascending palatine and tonsillar branches of facial artery, dorsal lingual branches of lingual artery	Circular pharyngeal
Mylohyoid	Mylohyoid line of mandible	Median raphe and body of hyoid bone	Nerve to mylohyoid nerve (branch of trigeminal nerve)	Elevates hyoid bone, base of tongue, floor of mouth; depresses mandible	Sublingual branch of lingual artery, submental branch of facial artery	Suprahyoid

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Nasalis	Canine eminence above and lateral to incisive fossa of maxilla	Aponeurosis on nasal cartilages	Zygomatic and buccal branches of facial nerve	Draws ala of nose toward septum, compresses nostrils; alar part opens nostrils	Superior labial, septal, and lateral nasal branches of facial artery	Facial expression
Occipital belly (occipitalis) of epicranius	Lateral 2/3 of superior nuchal line and mastoid process	Skin of occipital region, epicranial aponeurosis	Posterior auricular branches of facial nerve	Moves scalp backward	Occipital branch of posterior auricular artery, descending branch of occipital artery	Facial expression
Omohyoid	*Inferior belly:* from upper border of scapula and suprascapular ligament, ending in tendon under sternocleidomastoid muscle *Superior belly:* from this tendon	*Inferior belly:* to intermediate tendon *Superior belly:* to body of hyoid bone	Ansa cervicalis	Steadies hyoid bone and depresses hyoid	Hyoid branch of lingual artery, sternocleidomastoid branch of superior thyroid artery	Infrahyoid
Orbicularis oculi	Medial orbital margin, palpebral ligament, lacrimal bone	Skin around orbit, palpebral ligament, upper and lower eyelids	Facial nerve (CN VII)	Closes eyelids	Facial and superficial temporal arteries	Facial expression
Orbicularis oris	Maxilla above incisor teeth	Skin around lips	Zygomatic, buccal, and mandibular branches of facial nerve	Compression, contraction, and protrusion of lips	Inferior and superior labial branches of facial artery	Facial expression
Palatoglossus	Palatine aponeurosis of soft palate	Lateral aspect of tongue	Vagus nerve via pharyngeal plexus	Elevates posterior tongue, depresses palate	Ascending pharyngeal arteries, palatine branches of facial and maxillary arteries	Palatal
Palatopharyngeus	Hard palate, superior palatine aponeurosis	Lateral pharyngeal wall	Vagus nerve via pharyngeal plexus	Tenses soft palate; pulls walls of pharynx superiorly, anteriorly, and medially during swallowing	Ascending palatine artery branch of facial artery, descending palatine artery branch of maxillary artery	Longitudinal pharyngeal
Platysma	Skin below clavicle, upper thorax	Mandible, oral muscles	Facial nerve	Tenses skin of neck	Submental and suprascapular arteries	Facial expression
Posterior crico-arytenoid	Posterior surface of lamina of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Abducts vocal folds	Superior and inferior thyroid arteries	Laryngeal
Procerus	Fascia covering lower parts of nasal bone and upper part of lateral nasal cartilage	Skin between and above eyebrow	Temporal and zygomatic branches of facial nerve	Draws down medial angle of eyebrows, produces transverse wrinkles over bridge of nose	Angular and lateral nasal branches of facial artery	Facial expression
Rectus capitis anterior	Lateral mass of atlas	Base of occipital bone in front of foramen magnum	Ventral rami of cervical nerves (C1–C2)	Flexes head	Muscular branches of vertebral artery, ascending pharyngeal artery	Prevertebral
Rectus capitis lateralis	Upper surface of transverse process of atlas	Inferior surface of jugular process of occipital bone	Ventral rami of cervical nerves (C1–C2)	Flexes head laterally to same side	Muscular branches of vertebral artery, occipital artery, ascending pharyngeal artery	Prevertebral
Risorius	Fascia over masseter superficial to platysma	Skin at angle of mouth	Zygomatic and buccal branches of facial nerve	Retracts angle of mouth	Superior labial branch of facial artery	Facial expression
Salpingopharyngeus	Pharyngotympanic (auditory, eustachian) tube	Side of pharyngeal wall	Vagus nerve via pharyngeal plexus	Elevates pharynx and larynx during swallowing and speaking	Pharyngeal branch of ascending pharyngeal artery	Longitudinal pharyngeal

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Scalene (anterior)	Anterior tubercles of transverse processes of C3–C6	Scalene tubercle on 1st rib	Anterior rami of cervical nerves (C5–C8)	Elevates 1st rib, bends neck	Ascending cervical branch of inferior thyroid artery	Prevertebral
Scalene (medius)	Posterior tubercles of transverse processes of C2–C7	Upper surface of 1st rib (behind subclavian groove)	Anterior rami of cervical nerves (C3–C7)	Elevates 1st rib, bends neck	Muscular branches of ascending cervical artery	Prevertebral
Scalene (posterior)	Posterior tubercles of transverse processes of C4–C6	Outer surface of 2nd rib (behind attachment of serratus anterior)	Anterior rami of lower four cervical nerves	Elevates 2nd rib, bends neck	Muscular branches of ascending cervical division of inferior thyroid artery, superficial branch of transverse cervical artery	Prevertebral
Sphincter pupillae	Circular smooth muscle of iris that passes around pupil	Blends with dilator pupillae fibers	Parasympathetic fibers via oculomotor nerve (CN III)	Constricts pupil	Ophthalmic artery	Intrinsic eye
Stapedius	Pyramidal eminence of temporal bone	Stapes	Facial nerve	Pulls stapes posteriorly to lessen oscillation of tympanic membrane	Posterior auricular, anterior tympanic, and middle meningeal arteries	Middle ear
Sternocleidomastoid	*Sternal head:* anterior surface of manubrium *Clavicular head:* upper surface of medial 1/3 of clavicle	Lateral surface of mastoid process; lateral half of superior nuchal line of occipital bone	Accessory nerve (CN XI)	*Bilaterally:* flex head, raise thorax *Unilaterally:* turns face toward opposite side	Sternocleidomastoid branch of superior thyroid and occipital arteries, muscular branch of suprascapular artery, occipital branch of posterior auricular artery	Neck
Sternohyoid	Posterior surface of manubrium sterni, posterior sternoclavicular ligament, medial end of clavicle	Medial part of lower border of body of hyoid bone	Ansa cervicalis	Depresses larynx and hyoid bone, steadies hyoid bone	Sternocleidomastoid and hyoid branches of superior thyroid artery, hyoid branch of lingual artery	Infrahyoid
Sternothyroid	Posterior surface of manubrium sterni below and deep to origin of sternohyoid, edge of first costal cartilage	Oblique line on lamina of thyroid cartilage	Ansa cervicalis	Depresses larynx and thyroid cartilage	Cricothyroid branch of superior thyroid artery	Infrahyoid
Styloglossus	Styloid process and stylohyoid ligament	Lateral and inferior aspect of tongue	Hypoglossal nerve (CN XII)	Retracts tongue and draws it up for swallowing	Sublingual artery	Extrinsic tongue
Stylohyoid	Posterior border of styloid process	Body of hyoid bone at junction with greater horn	Facial nerve	Elevates hyoid bone and base of tongue	Muscular branches of facial artery, muscular branches of occipital artery	Suprahyoid
Stylopharyngeus	Medial aspect of styloid process	Pharyngeal wall	Glossopharyngeal nerve (CN IX)	Elevates pharynx and larynx during swallowing and speaking	Ascending pharyngeal artery, ascending palatine and tonsillar branches of facial artery, dorsal branches of lingual artery	Longitudinal pharyngeal
Subclavius	Upper border of 1st rib and its cartilage	Inferior surface of middle third of clavicle	Nerve to subclavius	Anchors and depresses clavicle	Clavicular branch of thoraco-acromial artery	Neck
Superior longitudinal muscle of tongue	Submucous fibers at back of tongue	Tip of tongue; unites with muscle of opposite side	Hypoglossal nerve (CN XII)	Shortens tongue, turns tip and sides upward	Deep lingual branch of lingual artery, branches from facial artery	Intrinsic tongue
Superior oblique	Body of sphenoid (above optic foramen), medial to origin of superior rectus	Passes through trochlea, attaches to superior sclera between superior and lateral recti	Trochlear nerve (CN IV)	Abducts, depresses, and medially rotates eyeball	Ophthalmic artery	Extra-ocular

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Superior pharyngeal constrictor	Hamulus, pterygomandibular raphe, mylohyoid line of mandible	Median raphe of pharynx	Vagus nerve via pharyngeal plexus	Constricts wall of pharynx during swallowing	Ascending pharyngeal artery, ascending palatine and tonsillar branches of facial artery, dorsal branches of lingual artery	Circular pharyngeal
Superior rectus	Common tendinous ring	Superior aspect of eyeball, posterior to the corneoscleral junction	Oculomotor nerve (CN III), superior division	Elevates, adducts, and medially rotates eyeball	Ophthalmic artery	Extra-ocular
Temporalis	Floor of temporal fossa, deep temporal fascia	Coronoid process and ramus of mandible	Mandibular nerve (CN V_3),deep temporal nerves	Elevates mandible; posterior fibers retrude mandible	Superficial temporal and maxillary arteries, middle, anterior, and posterior deep temporal arteries	Mastication
Tensor tympani	Cartilage of pharyngotympanic (auditory, eustachian) tube	Handle of malleus	Mandibular branch of trigeminal nerve (CN V_3)	Tenses tympanic membrane by drawing it medially	Superior tympanic branch of middle meningeal division of maxillary artery	Middle ear
Tensor veli palatini	Scaphoid fossa of medial pterygoid plate, spine of sphenoid, pharyngotympanic (auditory, eustachian) tube	Palatine aponeurosis	Mandibular nerve	Tenses soft palate, opens pharyngotympanic (auditory, eustachian) tube during swallowing and yawning	Ascending palatine artery branch of facial artery, descending palatine artery branch of maxillary artery	Palatal
Thyro-arytenoid	Posterior aspect of thyroid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Shortens and relaxes vocal cords, sphincter of vestibule	Superior and inferior thyroid arteries	Laryngeal
Thyrohyoid	Oblique line on lamina of thyroid cartilage	Lower border of body and greater horn of hyoid bone	Thyrohyoid branch of C1 nerve via hypoglossal nerve (CN XII)	Depresses larynx and hyoid bone, elevates thyroid cartilage	Hyoid branch of superior thyroid artery	Infrahyoid
Transverse and oblique arytenoid	Arytenoid cartilage	Opposite arytenoid cartilage	Recurrent laryngeal nerve	Closes intercartilaginous portion of rima glottides	Superior and inferior thyroid arteries	Laryngeal
Transverse (tongue)	Median fibrous septum of tongue	Dorsum and sides of tongue	Hypoglossal nerve (CN XII)	Narrows and elongates tongue	Deep lingual branch of lingual artery, branches from facial artery	Intrinsic tongue
Uvular muscle	Nasal spine, palatine aponeurosis	Mucosa of uvula	Vagus nerve via pharyngeal plexus	Shortens, elevates, and retracts uvula	Ascending palatine artery branch of facial artery, descending palatine artery branch of maxillary artery	Palatal
Vertical (tongue)	Mucous membrane on dorsum of forepart of tongue	Fibers extend from dorsum to undersurface of tongue	Hypoglossal nerve (CN XII)	Flattens and broadens tongue	Deep lingual branch of lingual artery, branches from facial artery	Intrinsic tongue
Vocalis	Vocal process of arytenoid cartilage	Vocal ligament	Recurrent laryngeal nerve	Tenses anterior vocal ligament, relaxes posterior vocal ligament	Superior and inferior thyroid arteries	Laryngeal
Zygomaticus major	Zygomatic arch	Angle of mouth	Zygomatic and buccal branches of facial nerve	Draws angle of mouth backward and upward	Superior labial branch of facial artery	Facial expression
Zygomaticus minor	Zygomatic arch	Angle of mouth, upper lip	Zygomatic and buccal branches of facial nerve	Elevates upper lip	Superior labial branch of facial artery	Facial expression



Section

2 BACK AND SPINAL CORD

Topographic Anatomy
Plate 152

152 Back: Surface Anatomy

Bones and Ligaments
Plates 153–159

153 Vertebral Column
154 Thoracic Vertebrae
155 Lumbar Vertebrae
156 Vertebrae: Radiology
157 Sacrum and Coccyx
158 Vertebral Ligaments: Lumbosacral Region
159 Vertebral Ligaments: Lumbar Region

Spinal Cord
Plates 160–170

160 Spinal Cord and Ventral Rami in Situ
161 Relation of Spinal Nerve Roots to Vertebrae
162 Dermatomes
163 Sympathetic Nervous System: Schema
164 Parasympathetic Nervous System: Schema
165 Spinal Membranes and Nerve Roots
166 Spinal Nerve Origin: Cross Sections
167 Arteries of Spinal Cord: Schema
168 Arteries of Spinal Cord: Intrinsic Distribution
169 Veins of Spinal Cord and Vertebral Column
170 Veins of Vertebral Column: Vertebral Veins

Muscles and Nerves

Plates 171–175

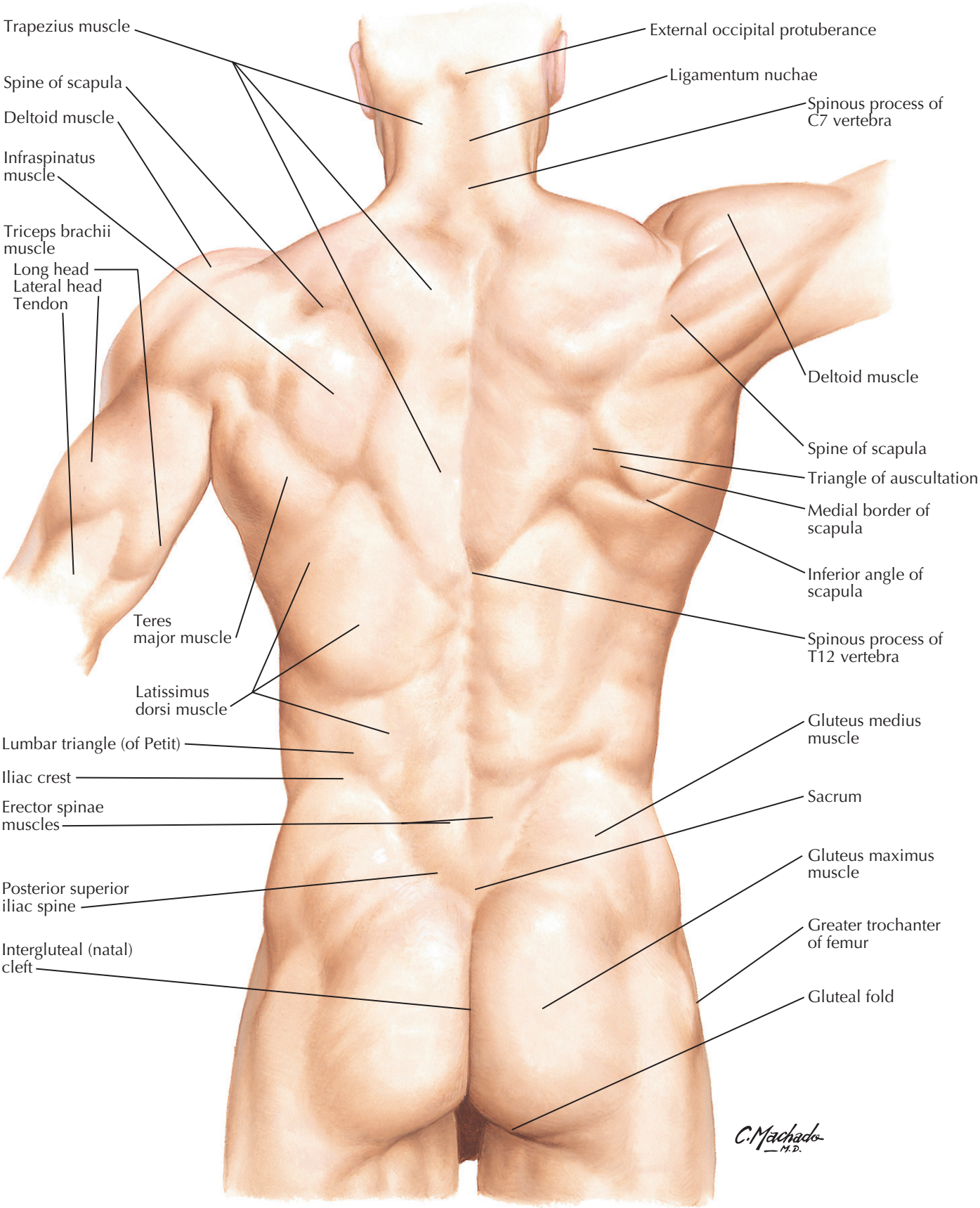
171 Muscles of Back: Superficial Layers
172 Muscles of Back: Intermediate Layers
173 Muscles of Back: Deep Layers
174 Nerves of Back
175 Suboccipital Triangle

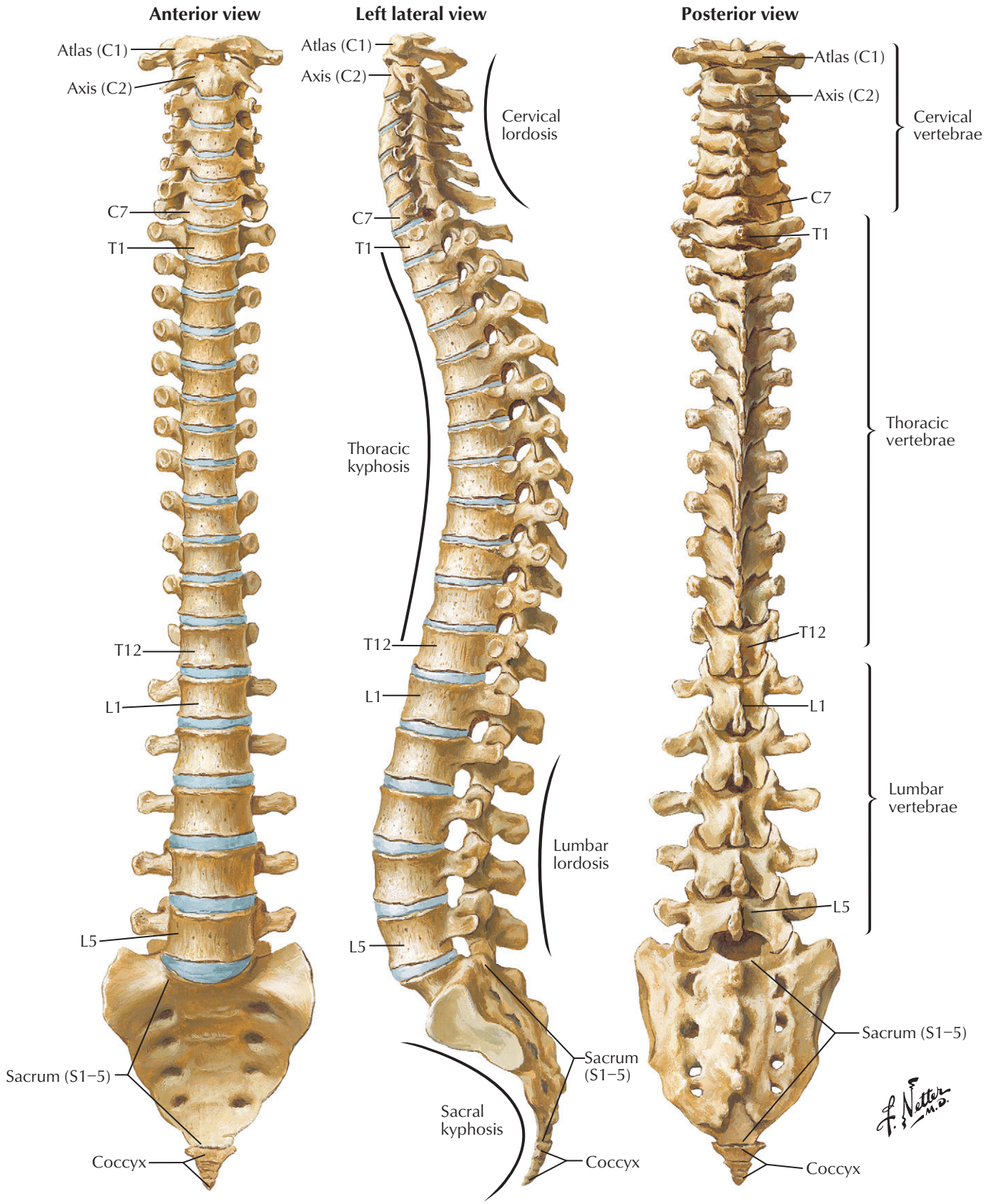
Cross-Sectional Anatomy

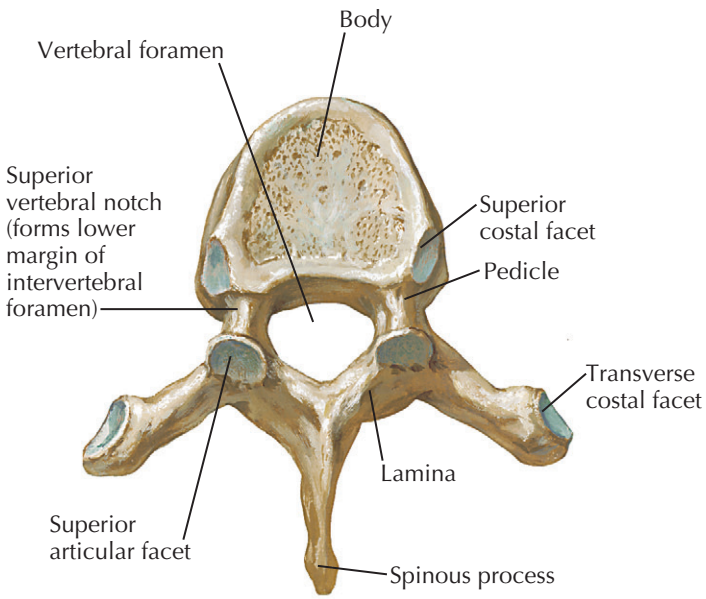
Plates 176–177

176 Lumbar Region of Back: Cross Section
177 Typical Thoracic Spinal Nerve: Cross Section

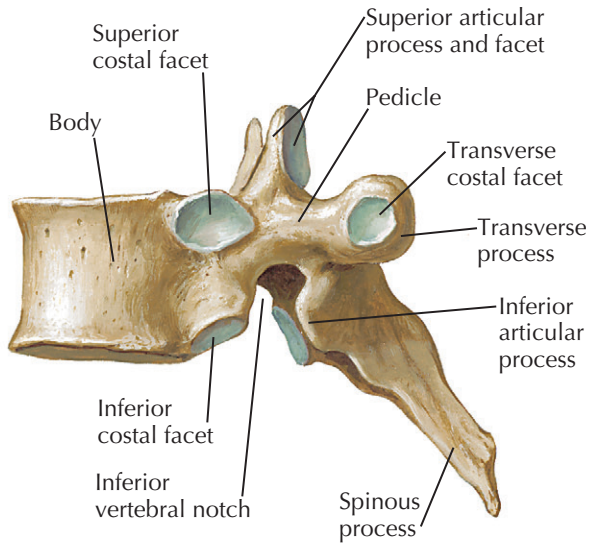
Muscle Tables


Trapezius muscle
Spine of scapula
Deltoid muscle
Infraspinatus muscle
Triceps brachii muscle
Long head
Lateral head
Tendon
Teres major muscle
Latissimus dorsi muscle
Lumbar triangle (of Petit)
Iliac crest
Erector spinae muscles
Posterior superior iliac spine
Intergluteal (natal) cleft
External occipital protuberance
Ligamentum nuchae
Spinous process of C7 vertebra
Deltoid muscle
Spine of scapula
Triangle of auscultation
Medial border of scapula
Inferior angle of scapula
Spinous process of T12 vertebra
Gluteus medius muscle
Sacrum
Gluteus maximus muscle
Greater trochanter of femur
Gluteal fold
C. Machado M.D.

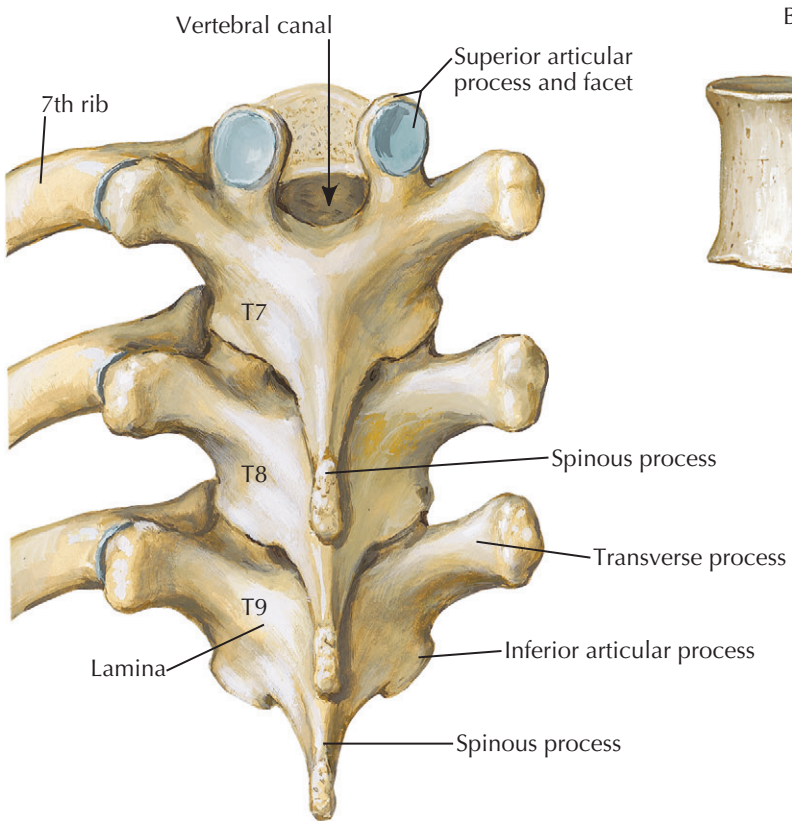

Anterior view
Left lateral view
Posterior view
Atlas (C1)
Axis (C2)
C7
T1
T12
L1
L5
Sacrum (S1–5)
Coccyx
Cervical lordosis
Thoracic kyphosis
Lumbar lordosis
Sacral kyphosis
Cervical vertebrae
Thoracic vertebrae
Lumbar vertebrae



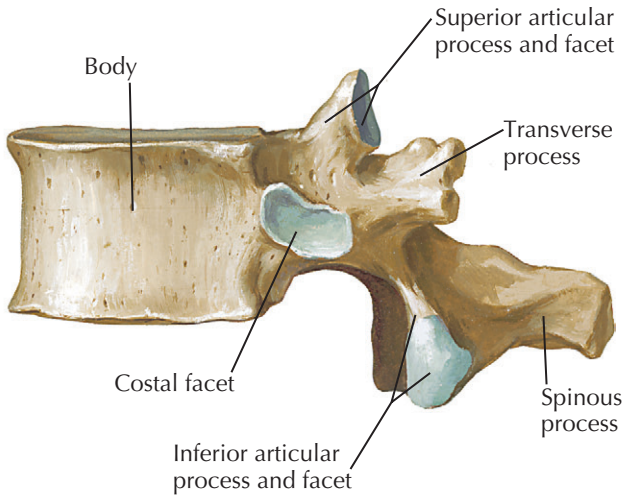
T6 vertebra: superior view



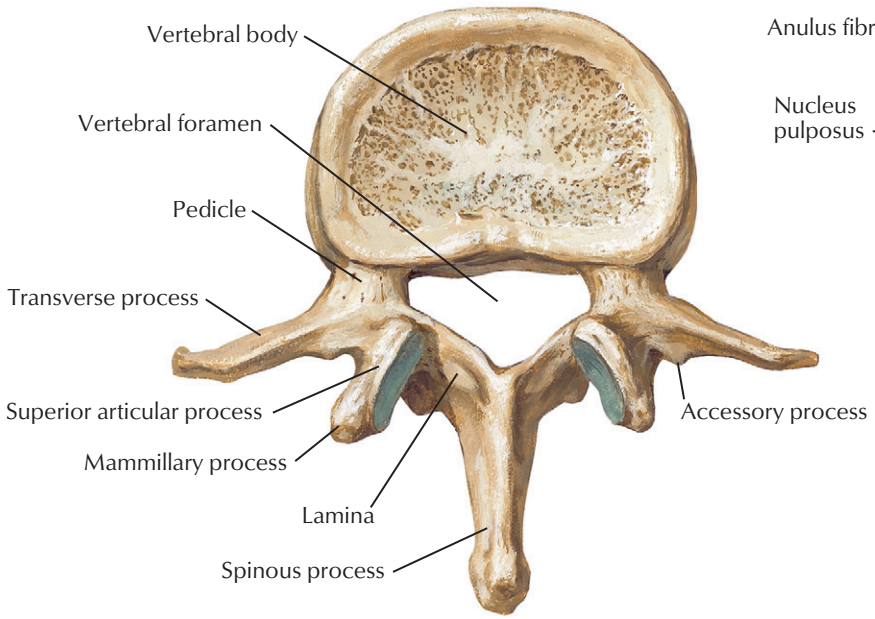
T6 vertebra: lateral view



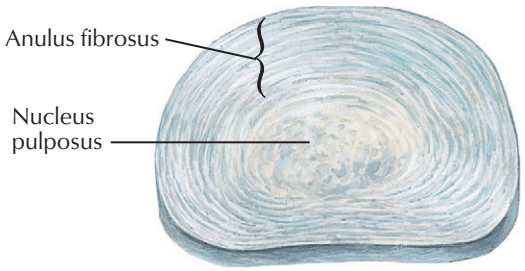
T7, T8, and T9 vertebrae: posterior view



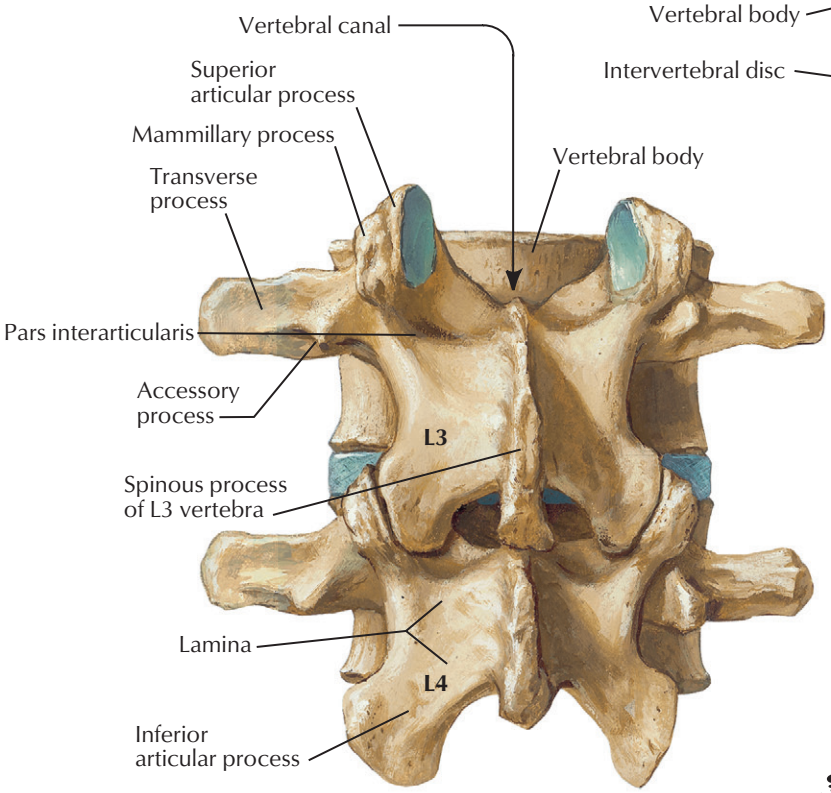
T12 vertebra: lateral view



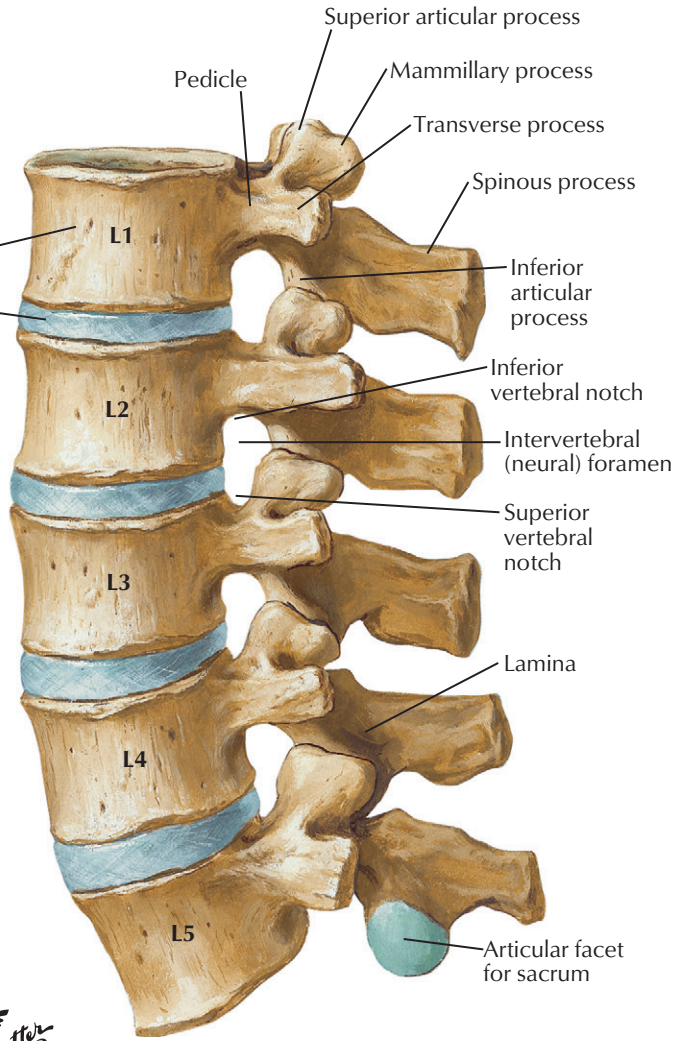
L2 vertebra: superior view



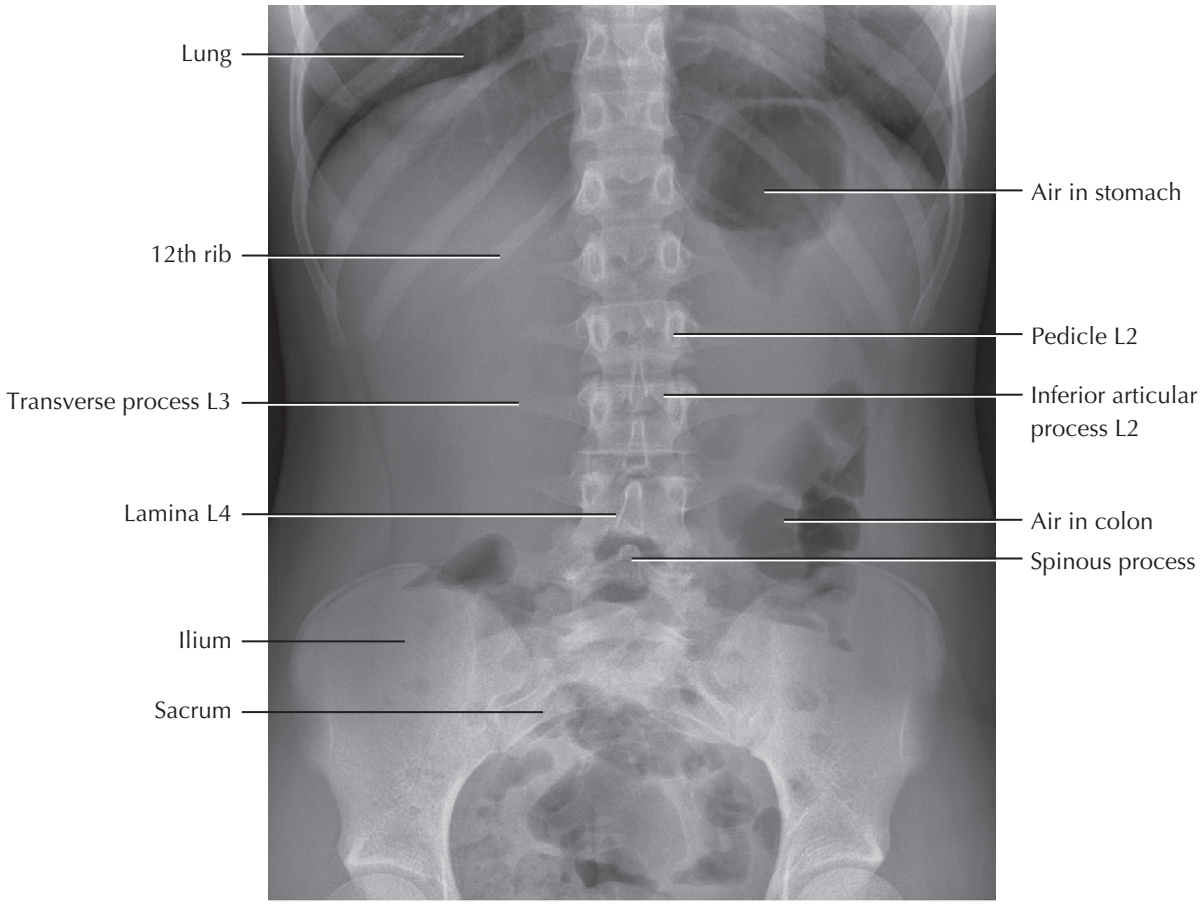
Intervertebral disc

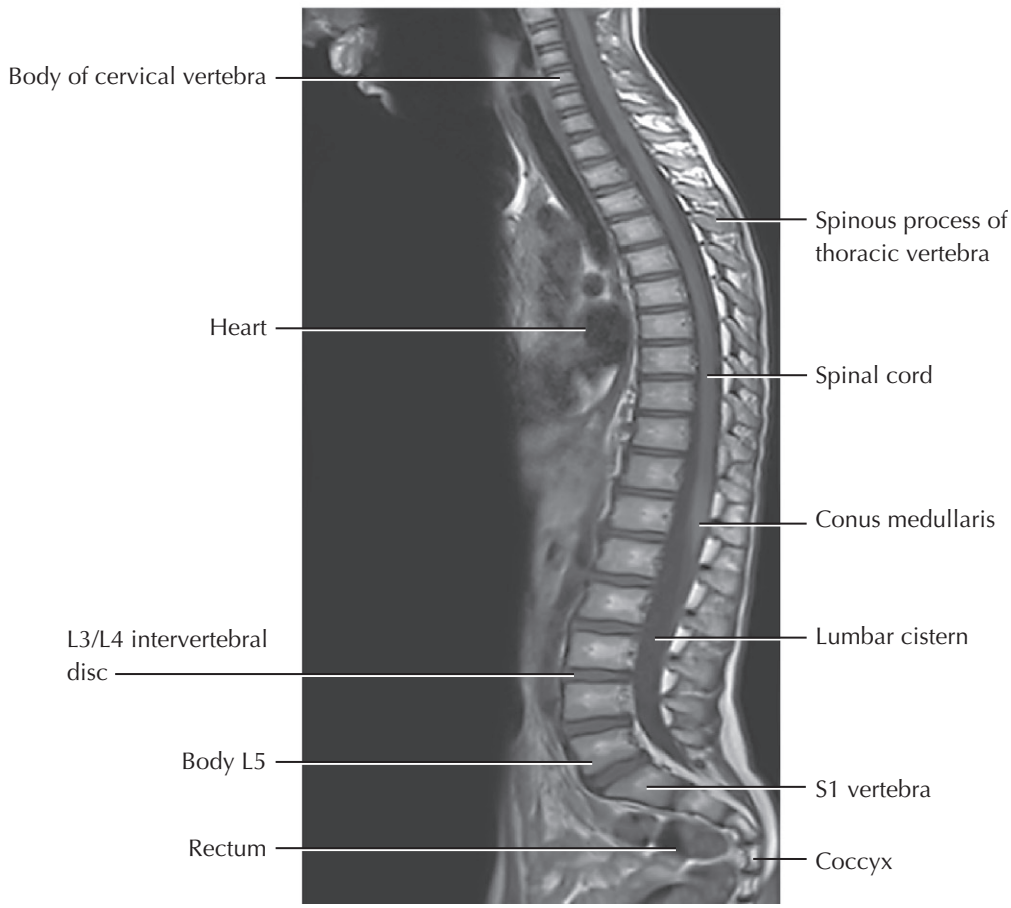


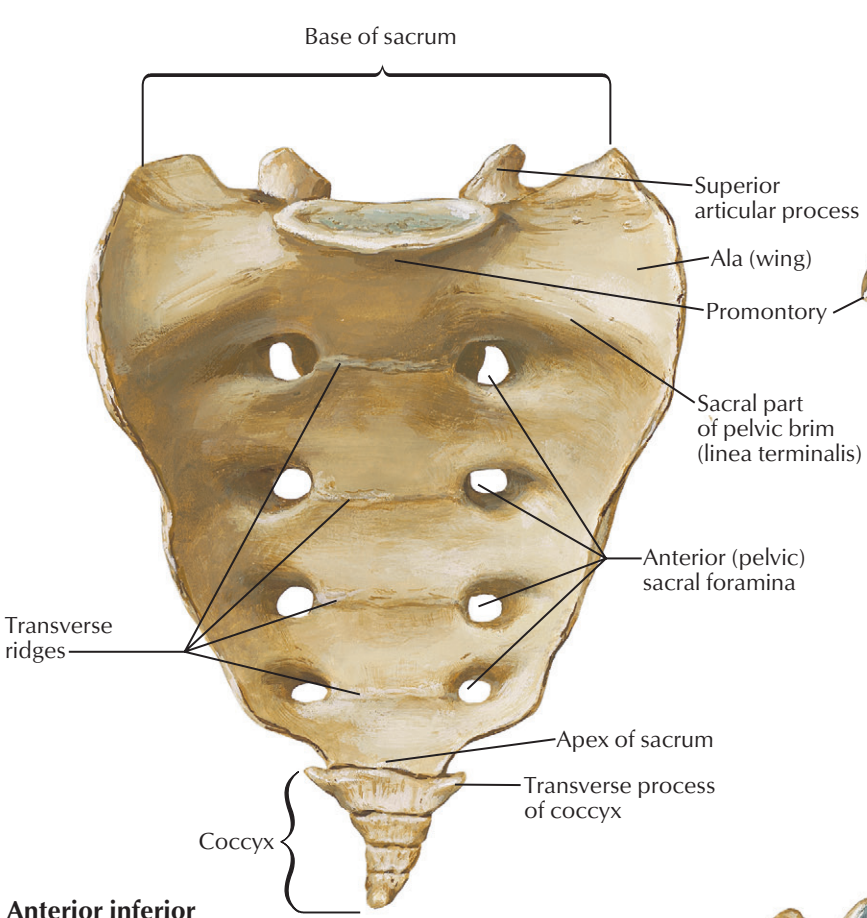
L3 and L4 vertebrae: posterior view

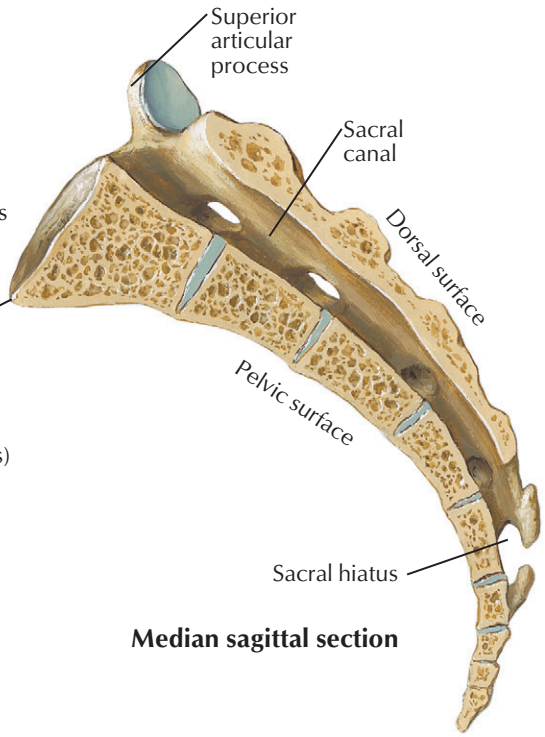


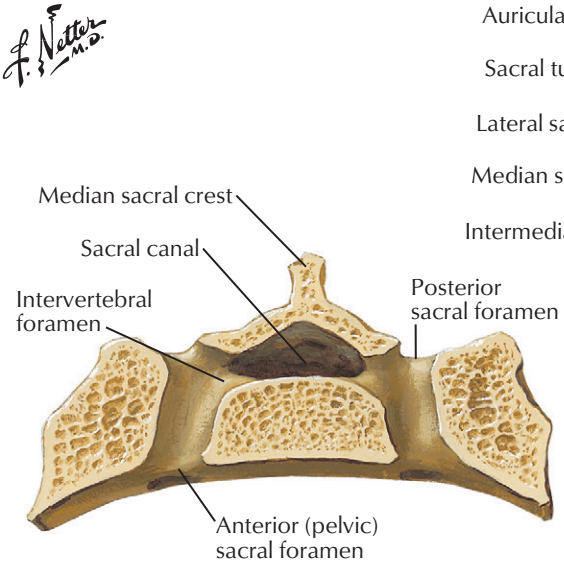
Lumbar vertebrae, articulated: left lateral view

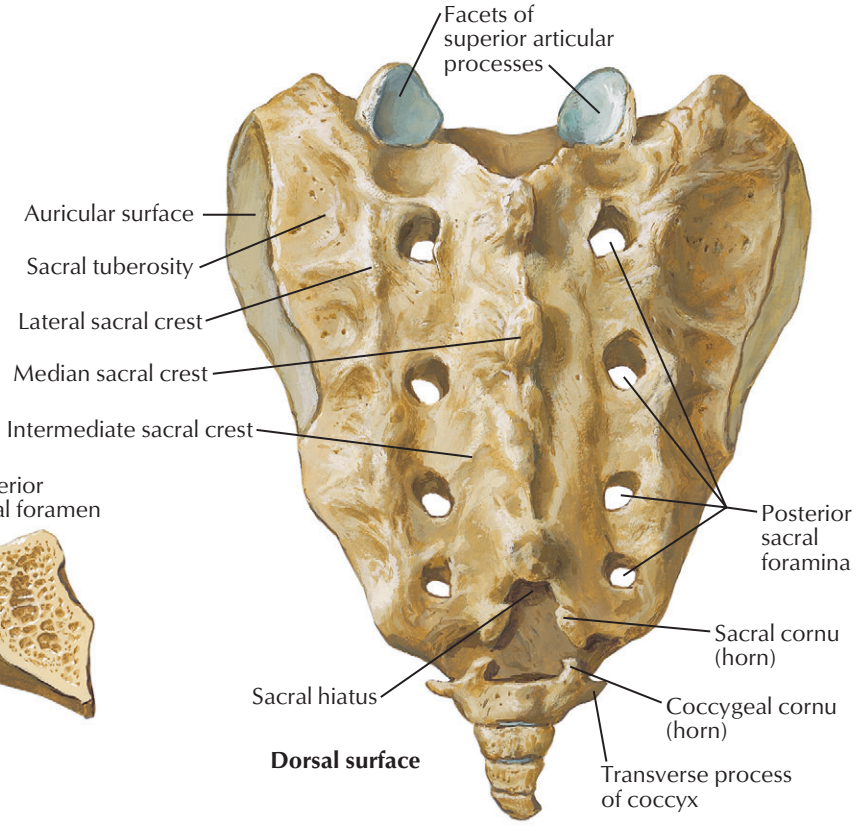

Lung
12th rib
Transverse process L3
Lamina L4
Ilium
Sacrum
Air in stomach
Pedicle L2
Inferior articular process L2
Air in colon
Spinous process

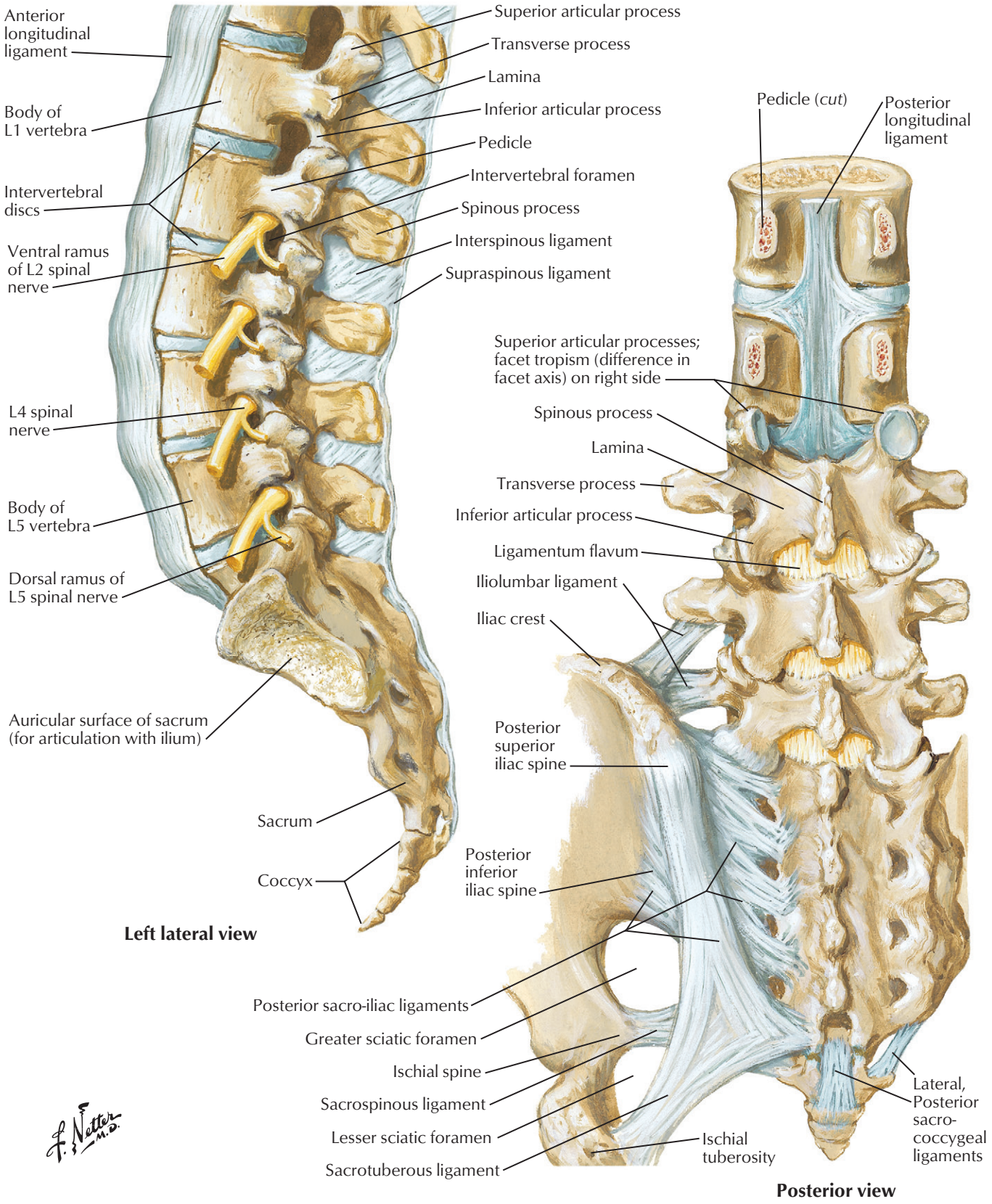

Body of cervical vertebra
Heart
L3/L4 intervertebral disc
Body L5
Rectum
Spinous process of thoracic vertebra
Spinal cord
Conus medullaris
Lumbar cistern
S1 vertebra
Coccyx


Base of sacrum
Superior articular process
Ala (wing)
Promontory
Sacral part of pelvic brim (linea terminalis)
Anterior (pelvic) sacral foramina
Transverse ridges
Apex of sacrum
Transverse process of coccyx
Coccyx
Anterior inferior view
Pelvic surface

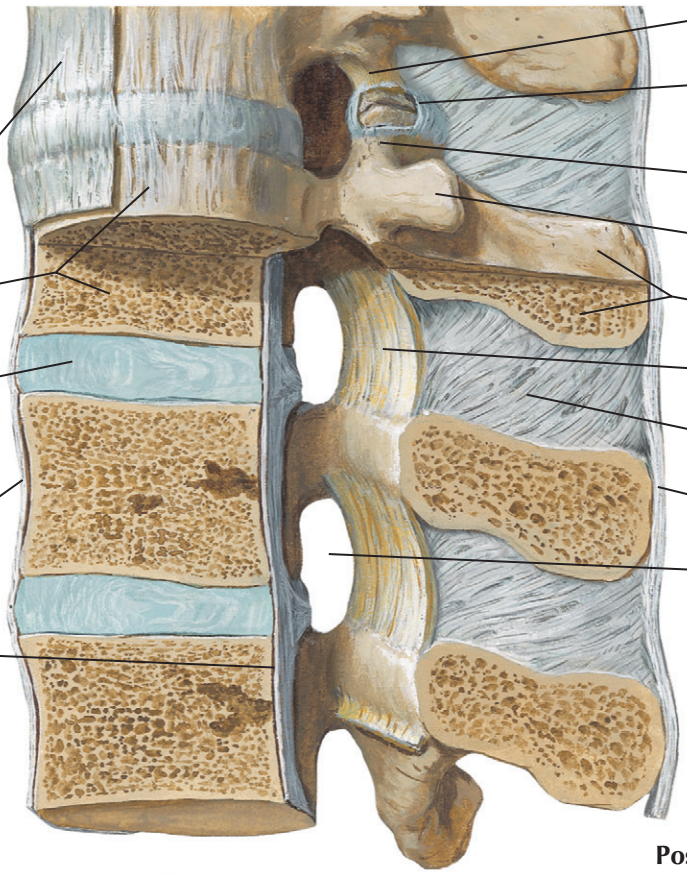

Superior articular process
Sacral canal
Dorsal surface
Pelvic surface
Sacral hiatus
Median sagittal section

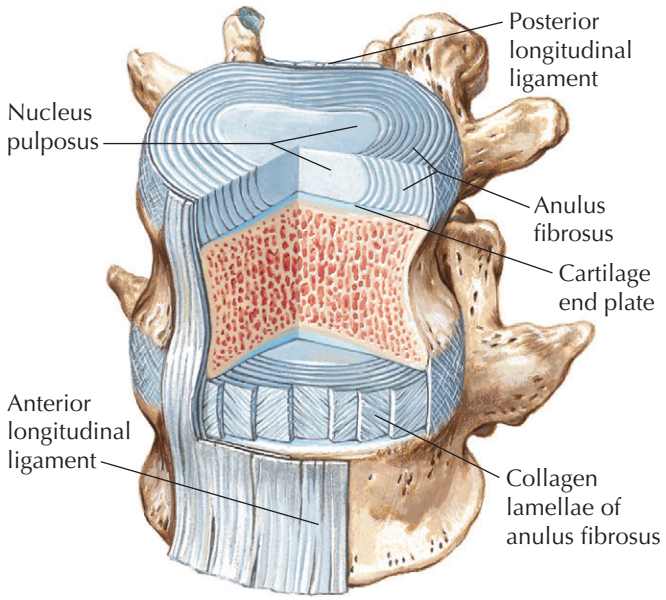

Median sacral crest
Sacral canal
Intervertebral foramen
Posterior sacral foramen
Anterior (pelvic) sacral foramen
Transverse section through S2 foramina


Facets of superior articular processes
Auricular surface
Sacral tuberosity
Lateral sacral crest
Median sacral crest
Intermediate sacral crest
Posterior sacral foramina
Sacral cornu (horn)
Sacral hiatus
Coccygeal cornu (horn)
Transverse process of coccyx
Dorsal surface
Posterior superior view


Anterior longitudinal ligament
Body of L1 vertebra
Intervertebral discs
Ventral ramus of L2 spinal nerve
L4 spinal nerve
Body of L5 vertebra
Dorsal ramus of L5 spinal nerve
Auricular surface of sacrum (for articulation with ilium)
Sacrum
Coccyx
Superior articular process
Transverse process
Lamina
Inferior articular process
Pedicle
Intervertebral foramen
Spinous process
Interspinous ligament
Supraspinous ligament
Left lateral view
Pedicle (cut)
Posterior longitudinal ligament
Superior articular processes; facet tropism (difference in facet axis) on right side
Spinous process
Lamina
Transverse process
Inferior articular process
Ligamentum flavum
Iliolumbar ligament
Iliac crest
Posterior superior iliac spine
Posterior inferior iliac spine
Posterior sacro-iliac ligaments
Greater sciatic foramen
Ischial spine
Sacrospinous ligament
Lesser sciatic foramen
Sacrotuberous ligament
Ischial tuberosity
Lateral, Posterior sacro-coccygeal ligaments
Posterior view

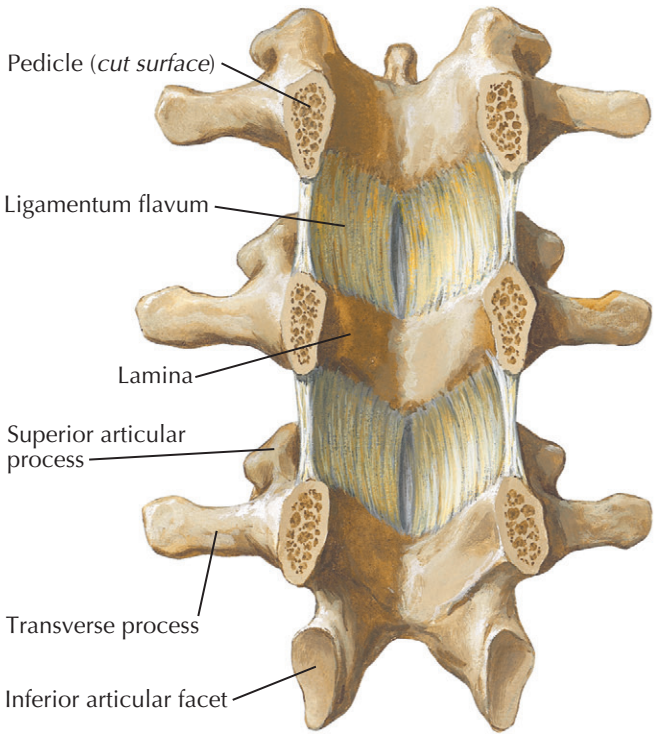
Left lateral view (*partially sectioned in median plane*)

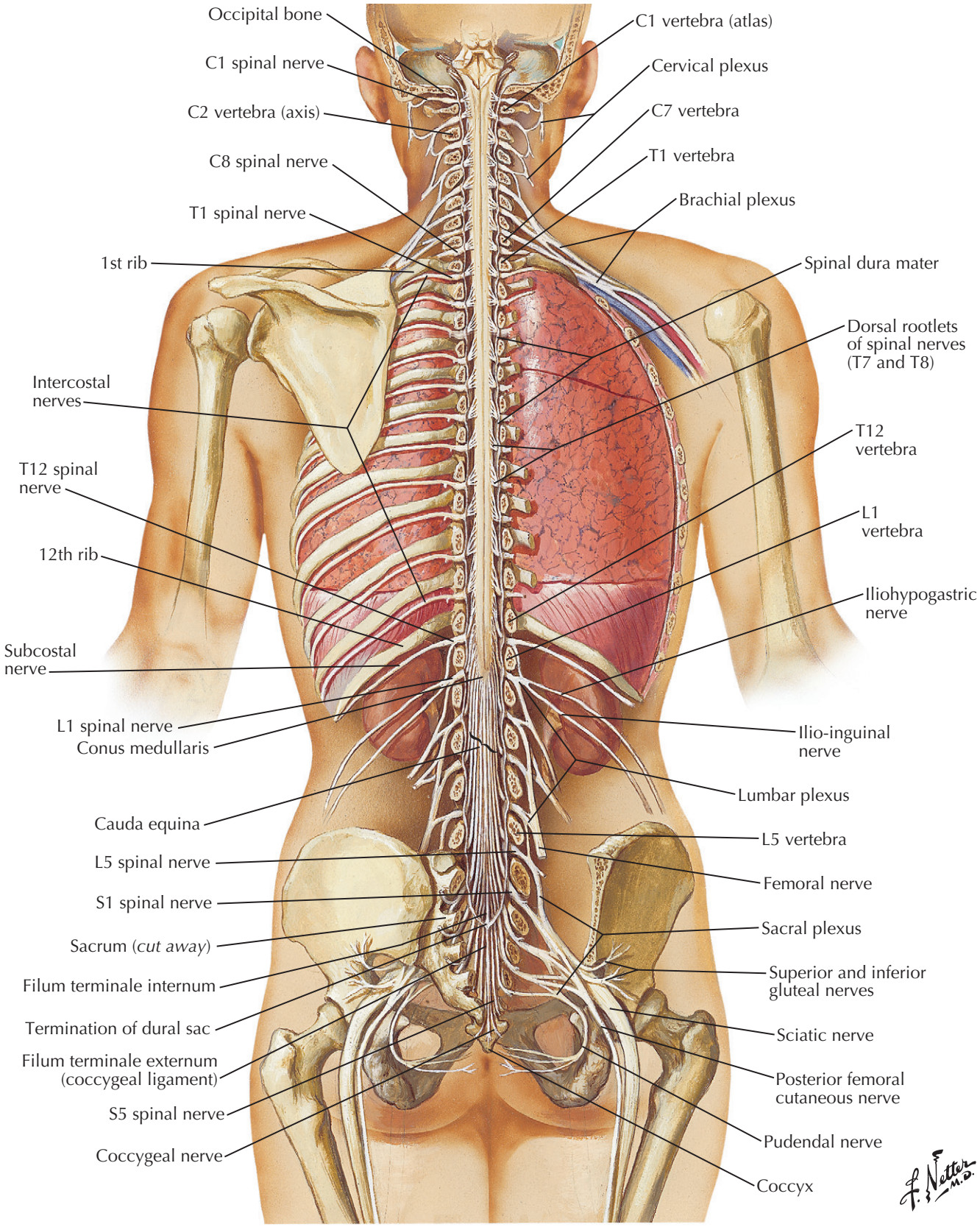




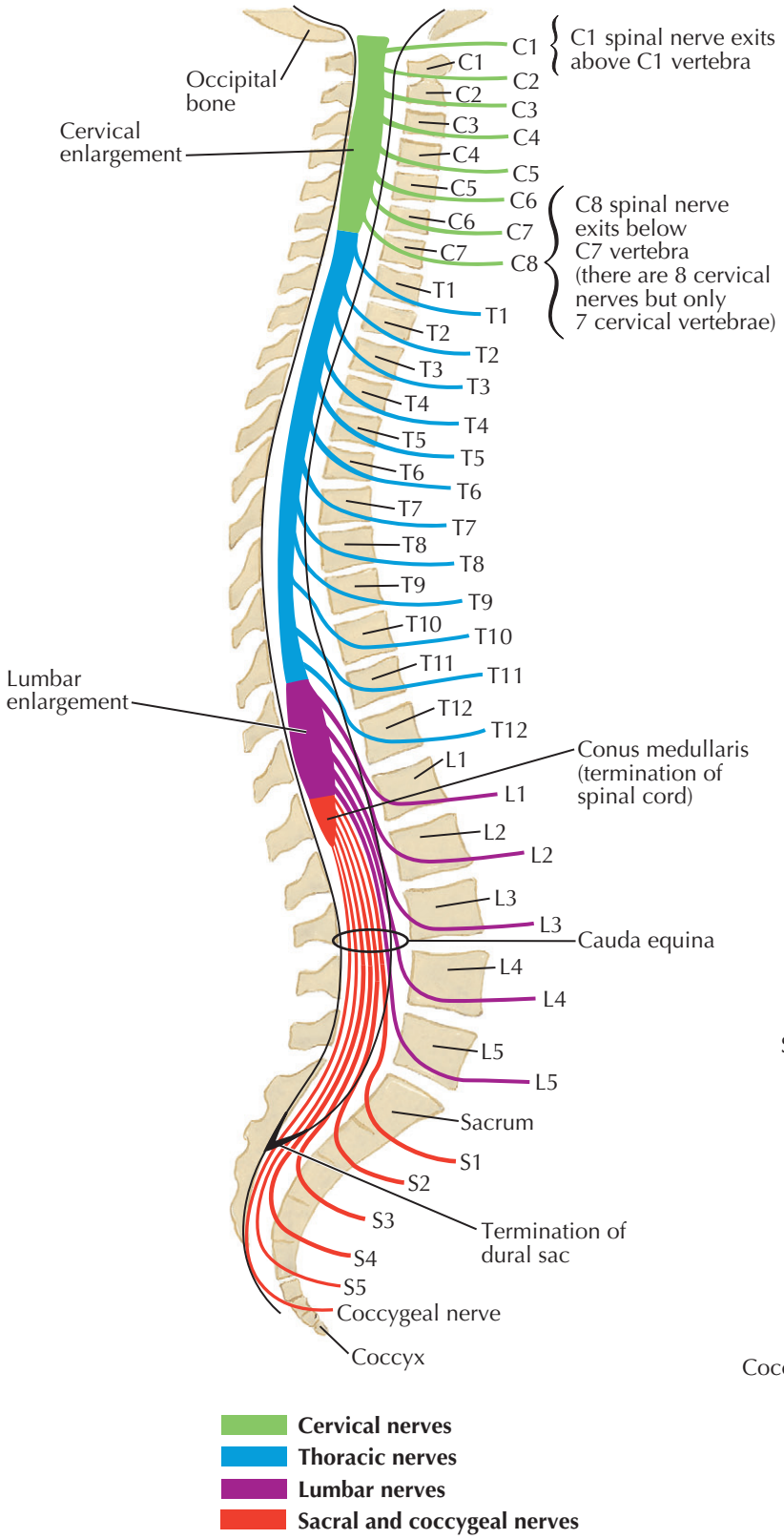
Intervertebral disc composed of central nuclear zone of collagen and hydrated proteoglycans surrounded by concentric lamellae of collagen fibers

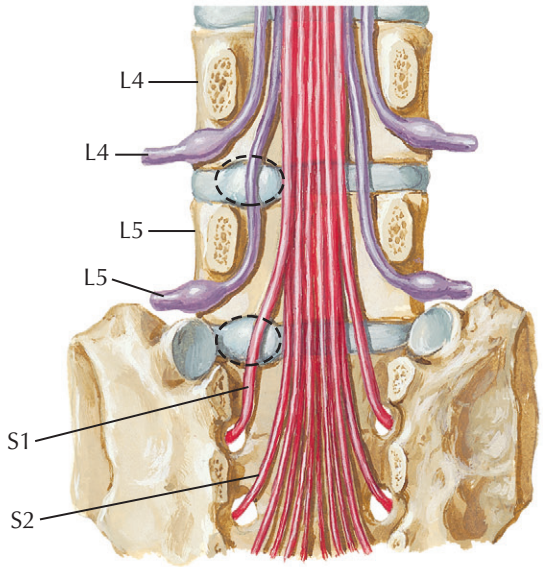
Posterior vertebral arches: anterior view



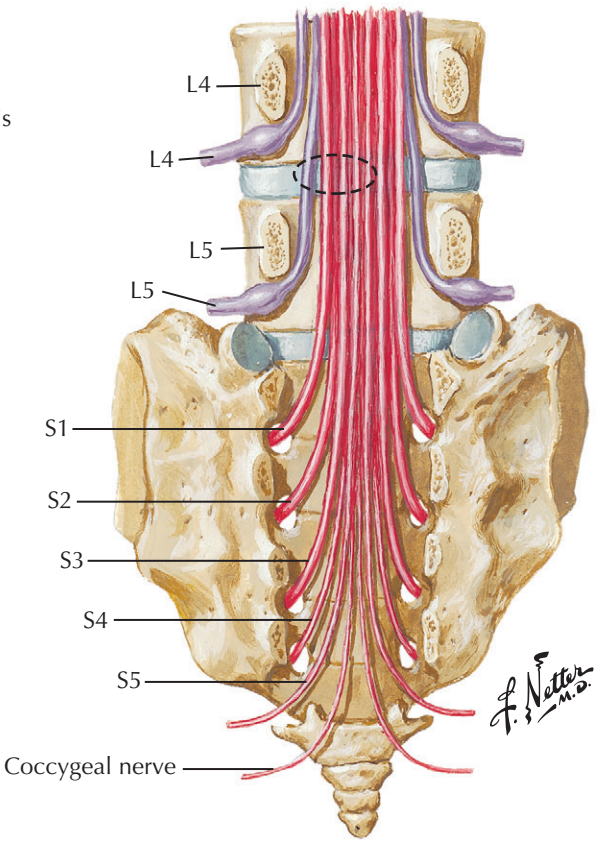

Occipital bone
C1 spinal nerve
C2 vertebra (axis)
C8 spinal nerve
T1 spinal nerve
1st rib
Intercostal nerves
T12 spinal nerve
12th rib
Subcostal nerve
L1 spinal nerve
Conus medullaris
Cauda equina
L5 spinal nerve
S1 spinal nerve
Sacrum (*cut away*)
Filum terminale internum
Termination of dural sac
Filum terminale externum (coccygeal ligament)
S5 spinal nerve
Coccygeal nerve
C1 vertebra (atlas)
Cervical plexus
C7 vertebra
T1 vertebra
Brachial plexus
Spinal dura mater
Dorsal rootlets of spinal nerves (T7 and T8)
T12 vertebra
L1 vertebra
Iliohypogastric nerve
Ilio-inguinal nerve
Lumbar plexus
L5 vertebra
Femoral nerve
Sacral plexus
Superior and inferior gluteal nerves
Sciatic nerve
Posterior femoral cutaneous nerve
Pudendal nerve
Coccyx
F. Netter M.D.

Relation of Spinal Nerve Roots to Vertebrae

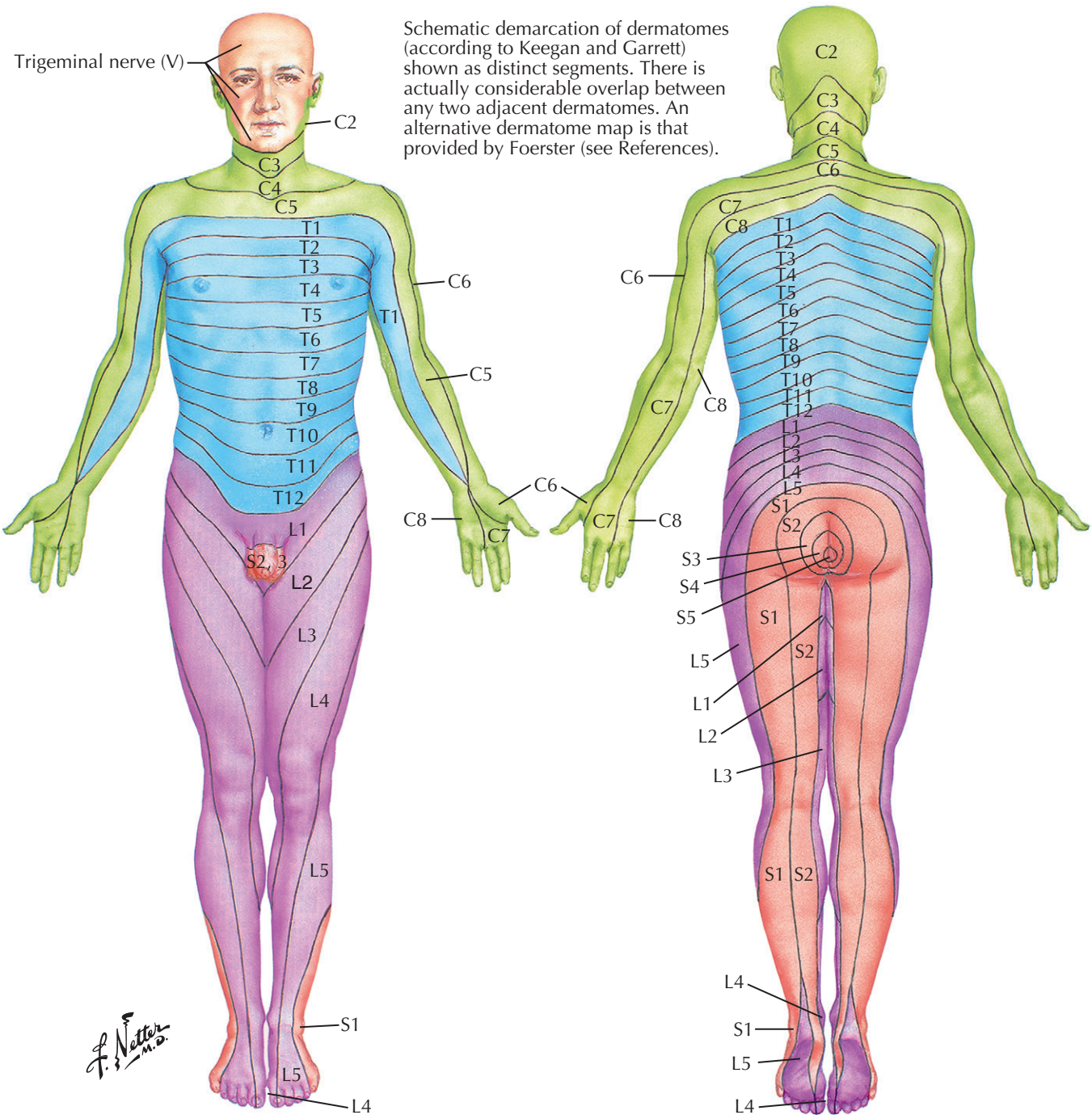




Lumbar disc protrusion (*dashed ovals*) does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4–5 affects L5 spinal nerve, not L4 spinal nerve. Protrusion at disc level L5–S1 affects S1 spinal nerve, not L5 spinal nerve.

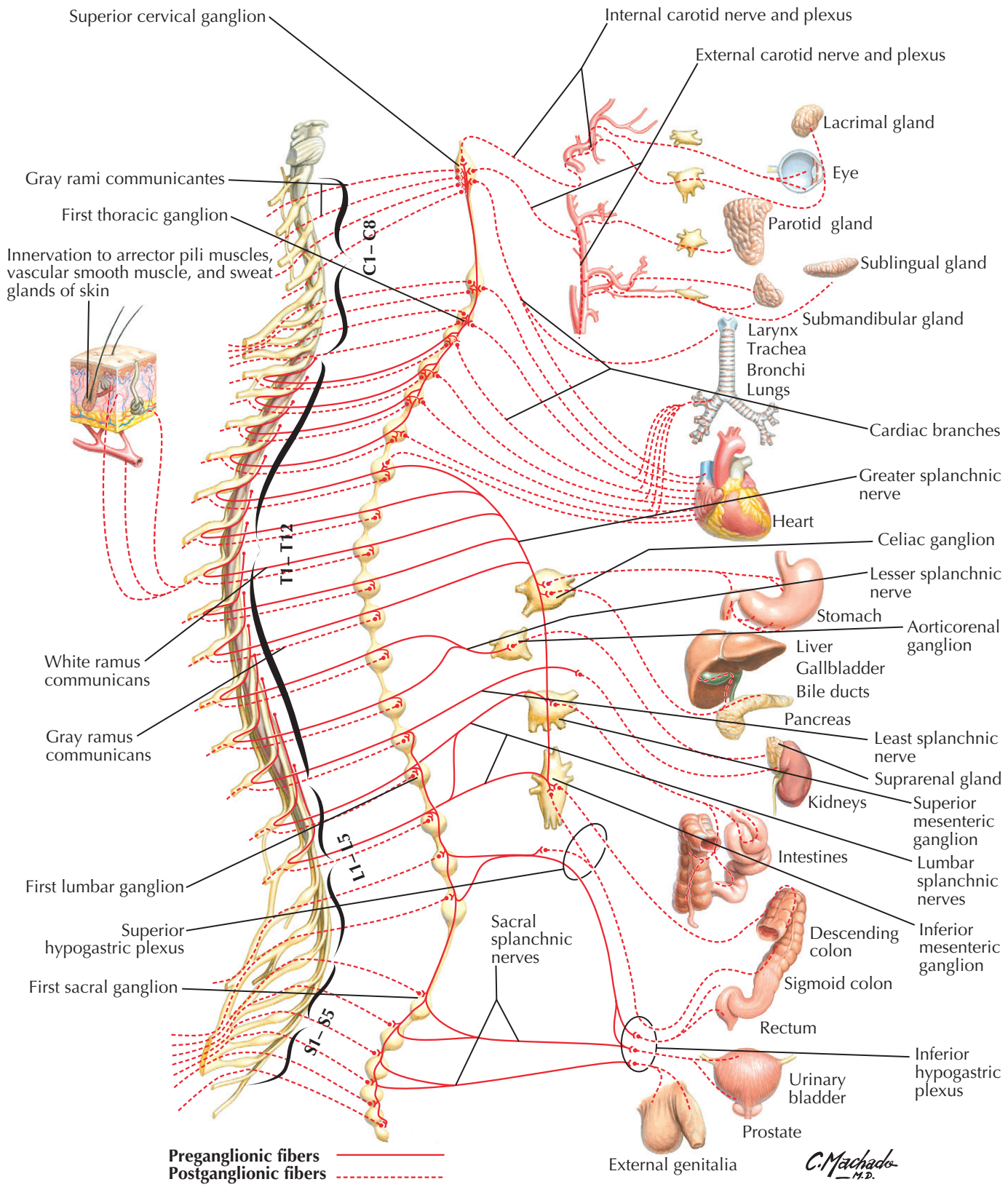


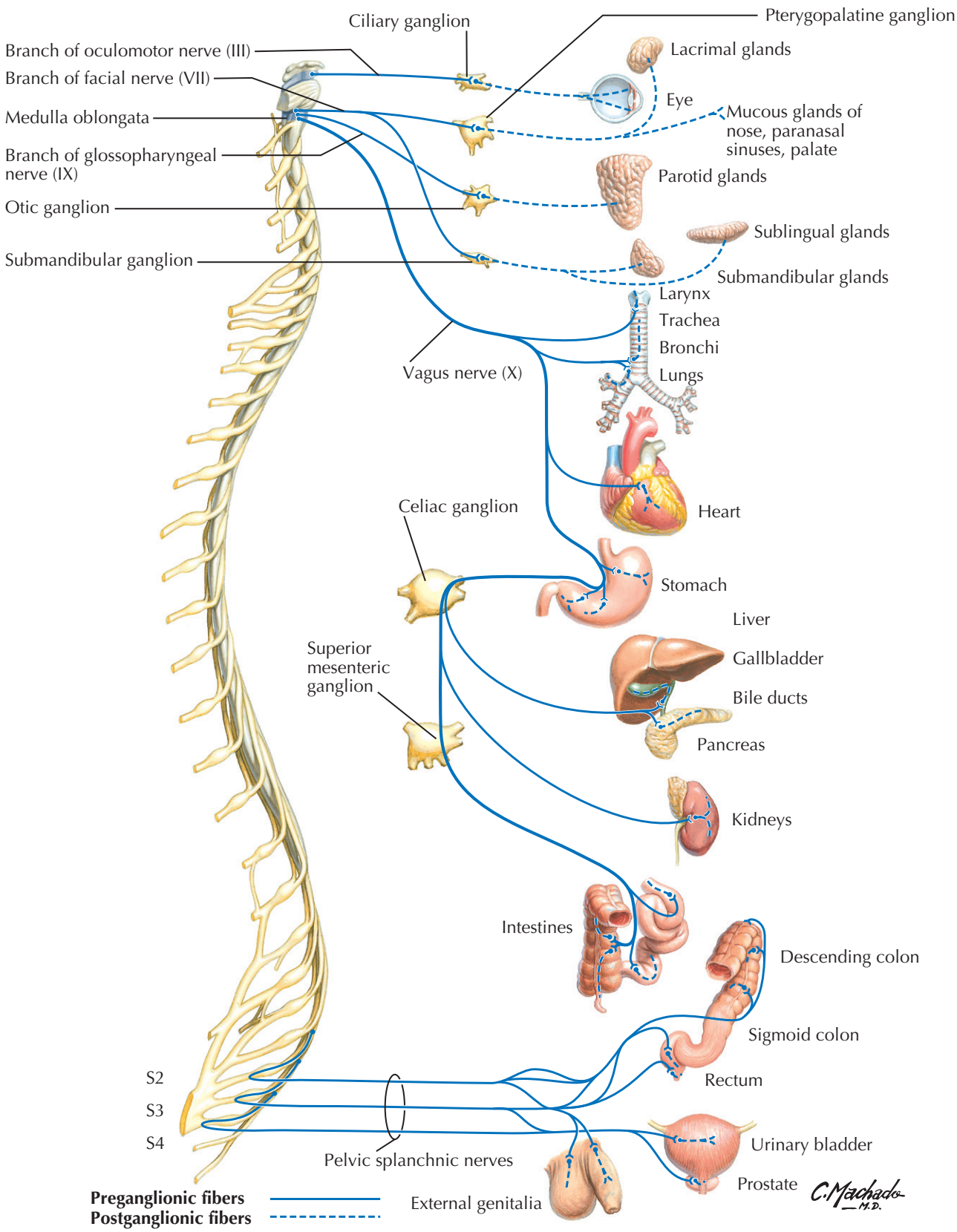
Medial protrusion at disc level L4–5 (*dashed oval*) rarely affects L4 spinal nerve but may affect L5 spinal nerve and sometimes S1–4 spinal nerves.



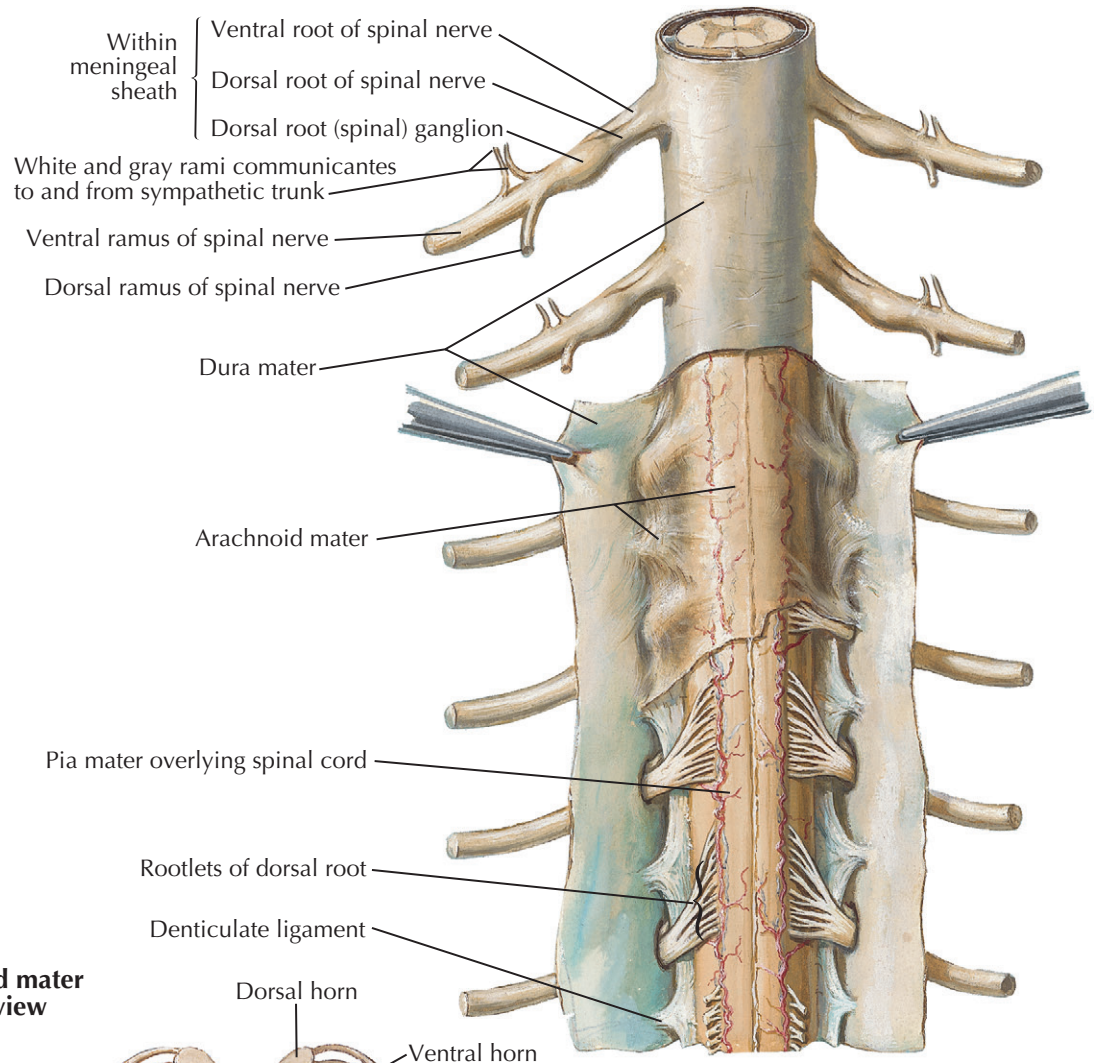
Levels of principal dermatomes

C5	Clavicles
C5, 6	Lateral sides of upper limbs
C8, T1	Medial sides of upper limbs
C6	Digit I (thumb)
C6, 7, 8	Hand
C8	Digits IV and V (ring and little fingers)
T4	Level of nipples
T10	Level of umbilicus
L1	Inguinal region
L1, 2, 3, 4	Anterior and inner surfaces of lower limbs
L4, 5, S1	Foot
L4	Medial side digit I (great toe)
L5, S1, 2	Lateral and posterior surfaces of lower limbs
S1	Lateral margin of foot and digit V (little toe)
S2, 3, 4	Perineum

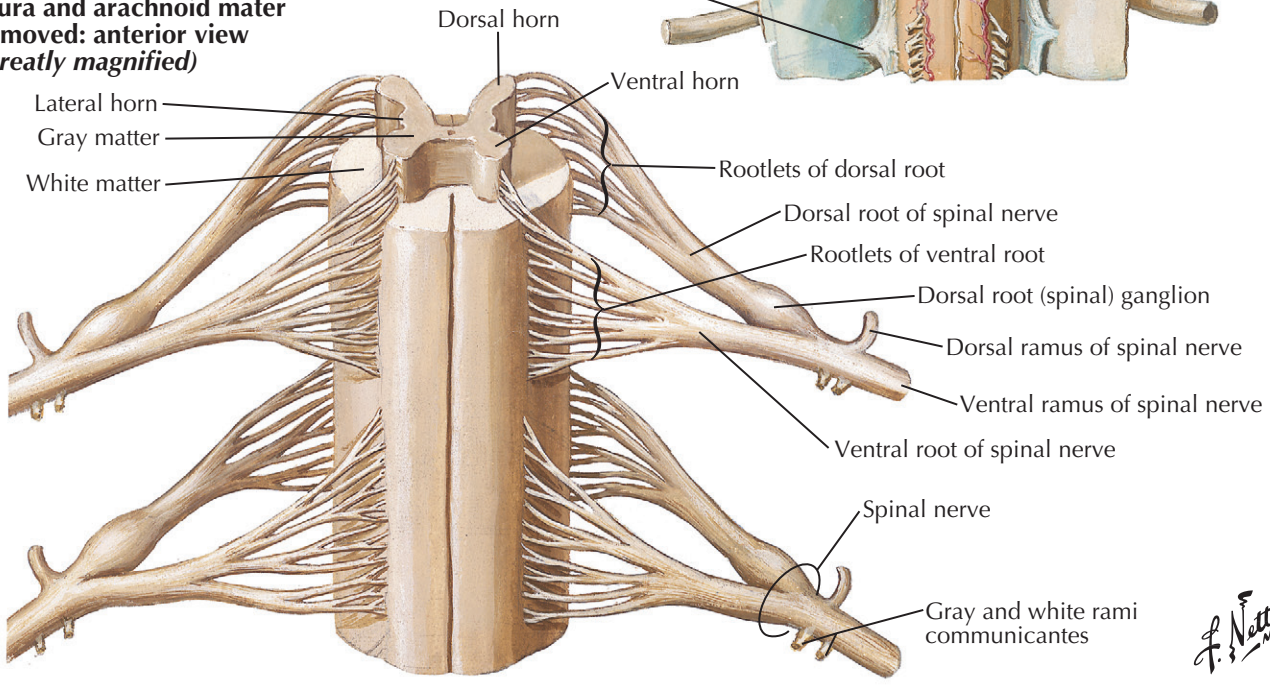

Superior cervical ganglion
Internal carotid nerve and plexus
External carotid nerve and plexus
Lacrimal gland
Eye
Parotid gland
Sublingual gland
Submandibular gland
Gray rami communicantes
First thoracic ganglion
Innervation to arrector pili muscles, vascular smooth muscle, and sweat glands of skin
C1–C8
T1–T12
L1–L5
S1–S5
Larynx
Trachea
Bronchi
Lungs
Cardiac branches
Greater splanchnic nerve
Heart
Celiac ganglion
Lesser splanchnic nerve
Stomach
Aorticorenal ganglion
Liver
Gallbladder
Bile ducts
Pancreas
Least splanchnic nerve
Suprarenal gland
Kidneys
Superior mesenteric ganglion
Intestines
Lumbar splanchnic nerves
Inferior mesenteric ganglion
White ramus communicans
Gray ramus communicans
First lumbar ganglion
Superior hypogastric plexus
First sacral ganglion
Sacral splanchnic nerves
Descending colon
Sigmoid colon
Rectum
Inferior hypogastric plexus
Urinary bladder
Prostate
External genitalia
Preganglionic fibers
Postganglionic fibers
C. Machado, M.D.


Ciliary ganglion
Pterygopalatine ganglion
Branch of oculomotor nerve (III)
Branch of facial nerve (VII)
Medulla oblongata
Branch of glossopharyngeal nerve (IX)
Otic ganglion
Submandibular ganglion
Lacrimal glands
Eye
Mucous glands of nose, paranasal sinuses, palate
Parotid glands
Sublingual glands
Submandibular glands
Larynx
Trachea
Bronchi
Lungs
Vagus nerve (X)
Heart
Celiac ganglion
Stomach
Liver
Gallbladder
Bile ducts
Pancreas
Superior mesenteric ganglion
Kidneys
Intestines
Descending colon
Sigmoid colon
Rectum
S2
S3
S4
Urinary bladder
Prostate
Pelvic splanchnic nerves
External genitalia
Preganglionic fibers
Postganglionic fibers
C. Machado M.D.

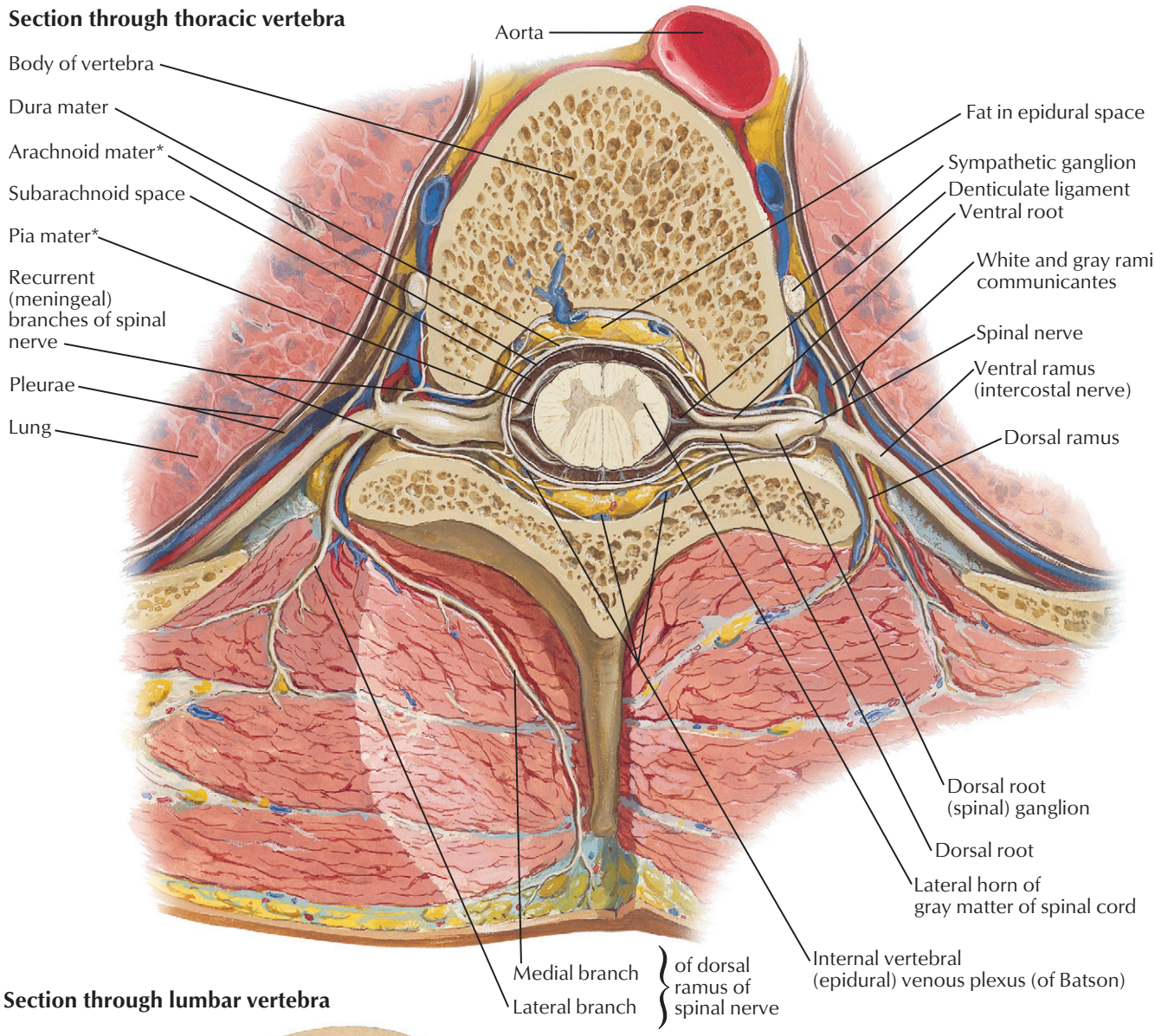
Posterior view



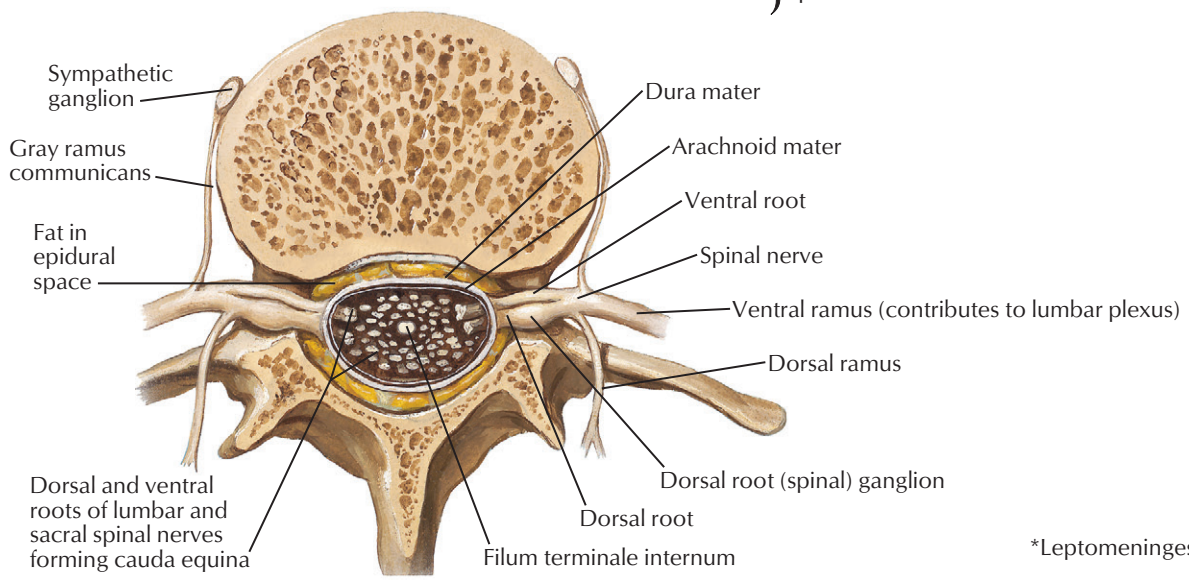
Dura and arachnoid mater removed: anterior view *(greatly magnified)*



Section through thoracic vertebra

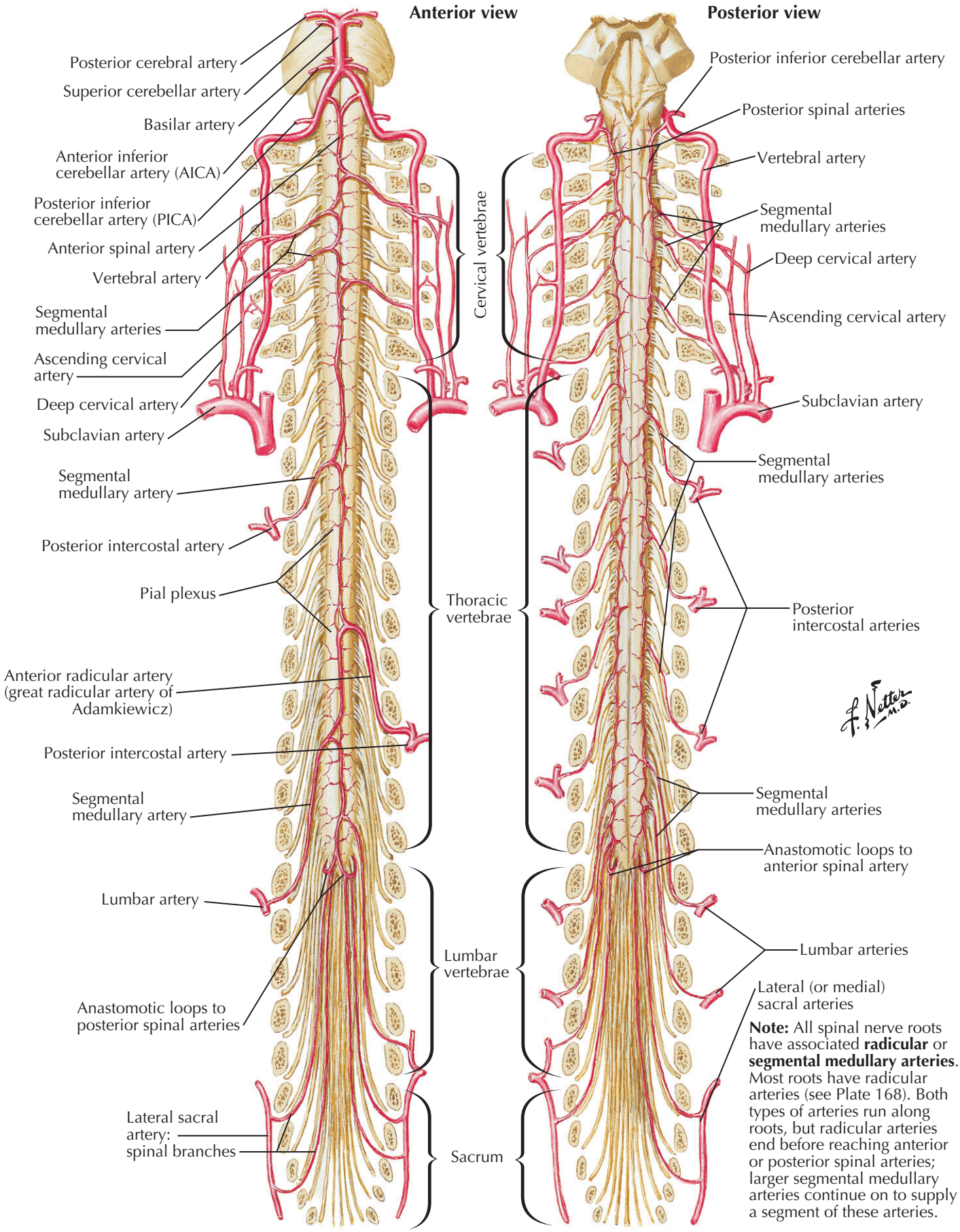


Section through lumbar vertebra



*Leptomeninges

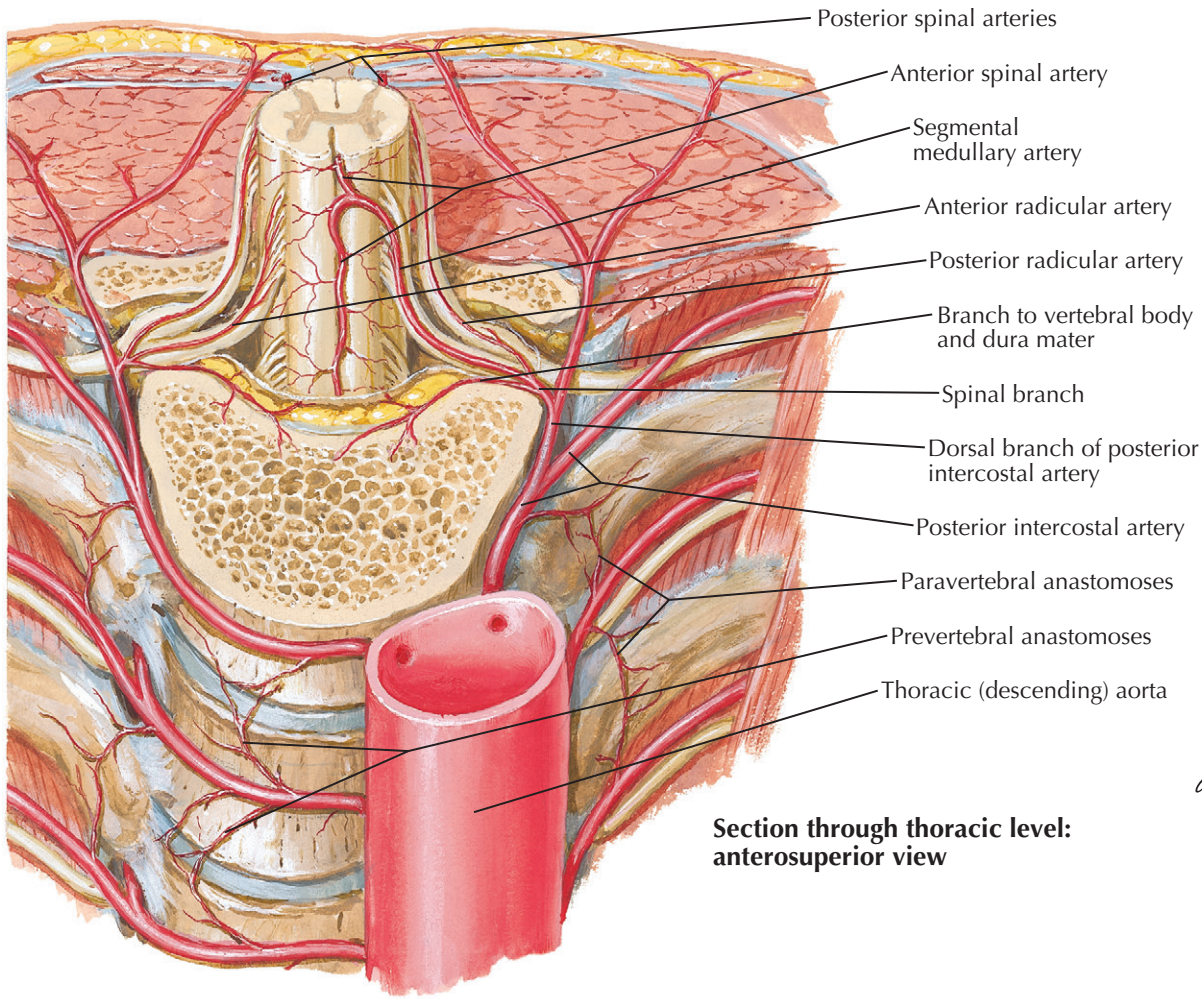
Arteries of Spinal Cord: Schema



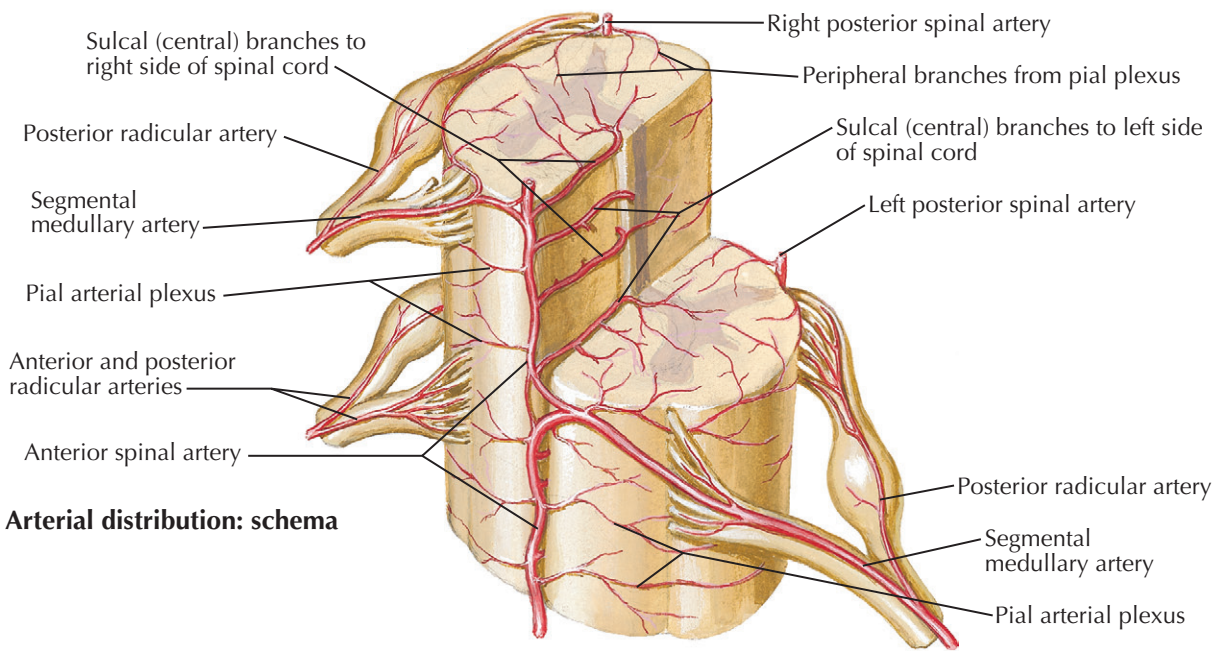
Note: All spinal nerve roots have associated **radicular** or **segmental medullary arteries**. Most roots have radicular arteries (see Plate 168). Both types of arteries run along roots, but radicular arteries end before reaching anterior or posterior spinal arteries; larger segmental medullary arteries continue on to supply a segment of these arteries.

Arteries of Spinal Cord: Intrinsic Distribution

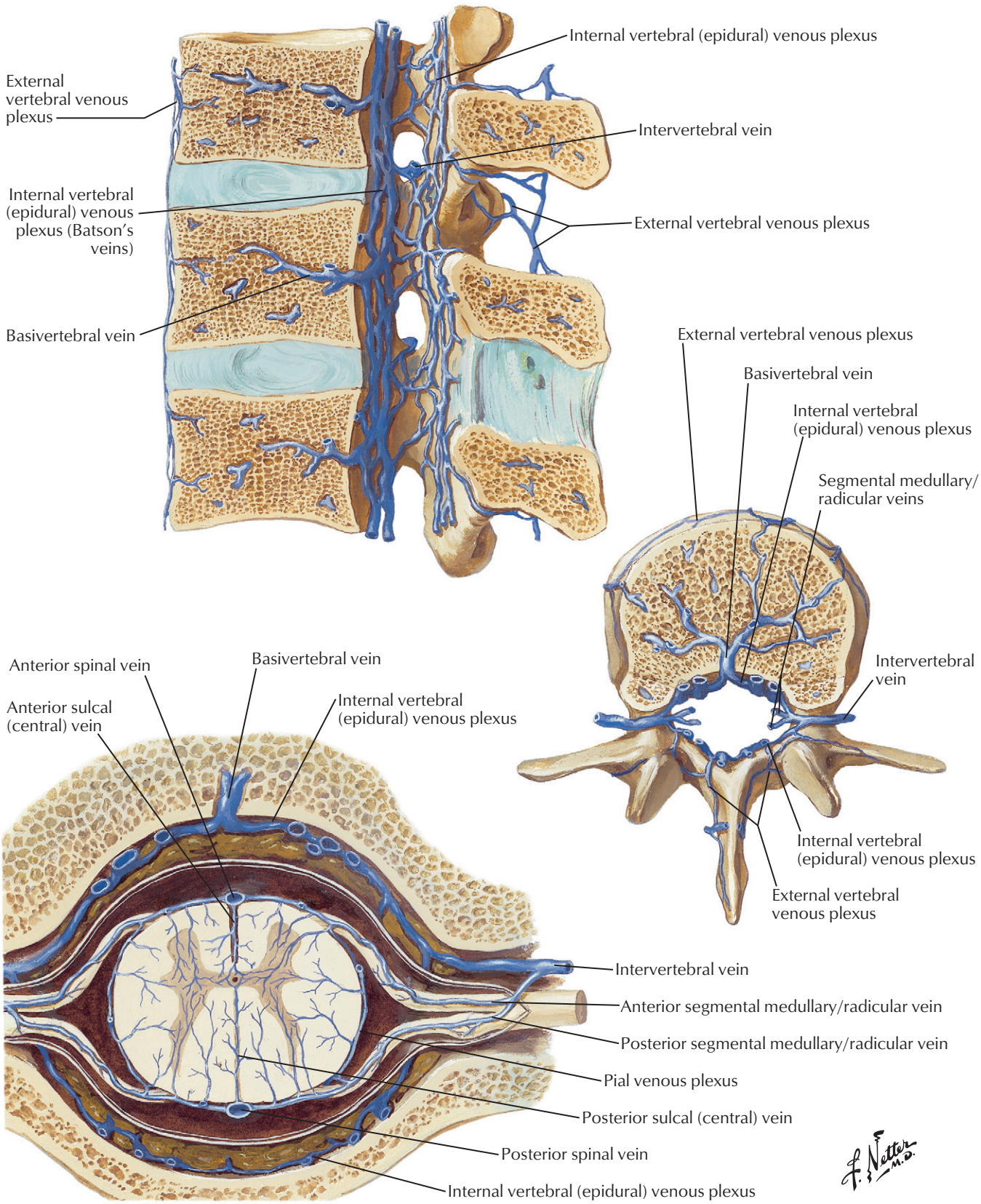
See also Plate 188

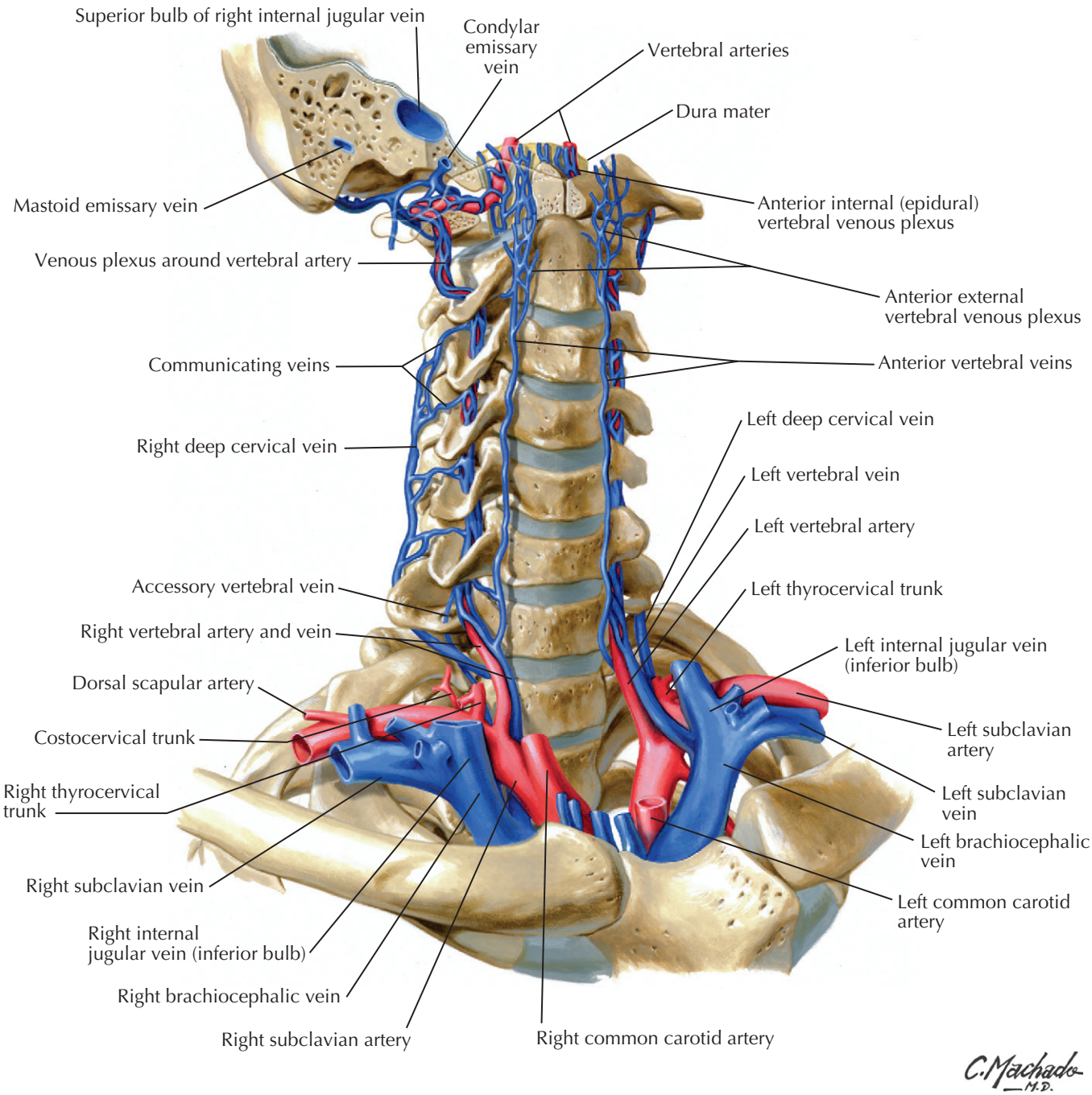


Section through thoracic level: anterosuperior view



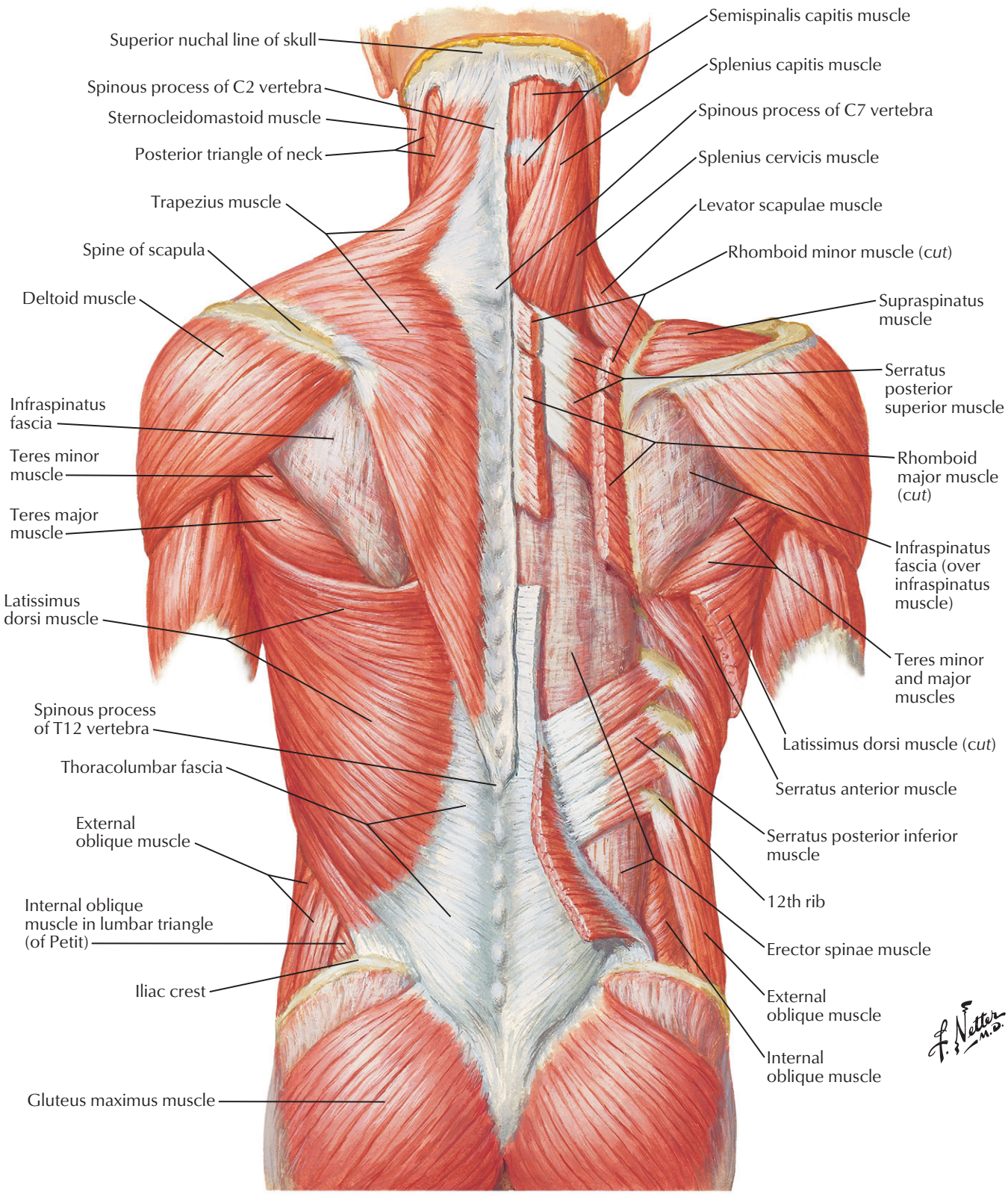
Arterial distribution: schema

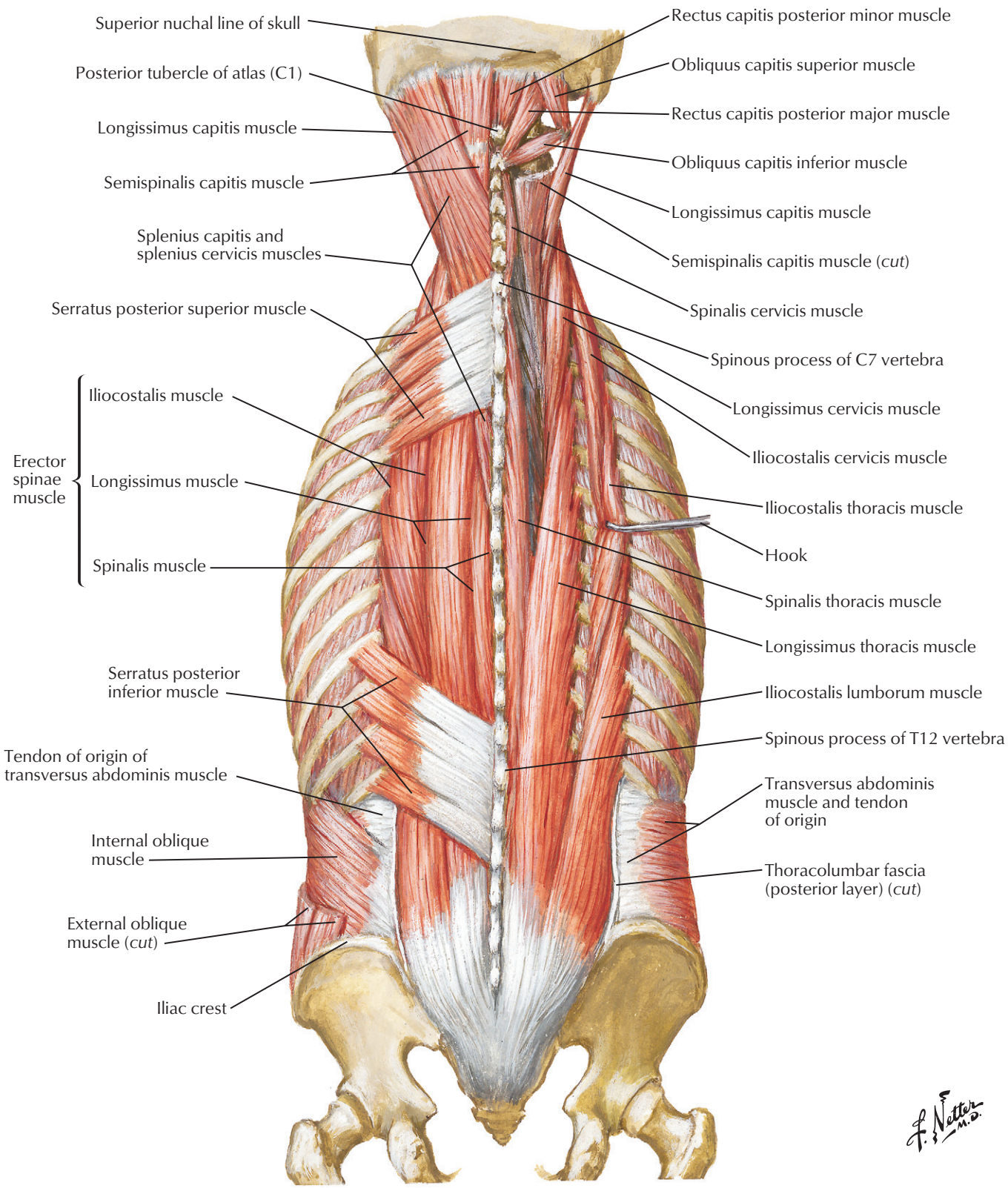

Internal vertebral (epidural) venous plexus
External vertebral venous plexus
Intervertebral vein
Internal vertebral (epidural) venous plexus (Batson's veins)
External vertebral venous plexus
Basivertebral vein
External vertebral venous plexus
Basivertebral vein
Internal vertebral (epidural) venous plexus
Segmental medullary/ radicular veins
Intervertebral vein
Internal vertebral (epidural) venous plexus
External vertebral venous plexus
Anterior spinal vein
Basivertebral vein
Anterior sulcal (central) vein
Internal vertebral (epidural) venous plexus
Intervertebral vein
Anterior segmental medullary/radicular vein
Posterior segmental medullary/radicular vein
Pial venous plexus
Posterior sulcal (central) vein
Posterior spinal vein
Internal vertebral (epidural) venous plexus

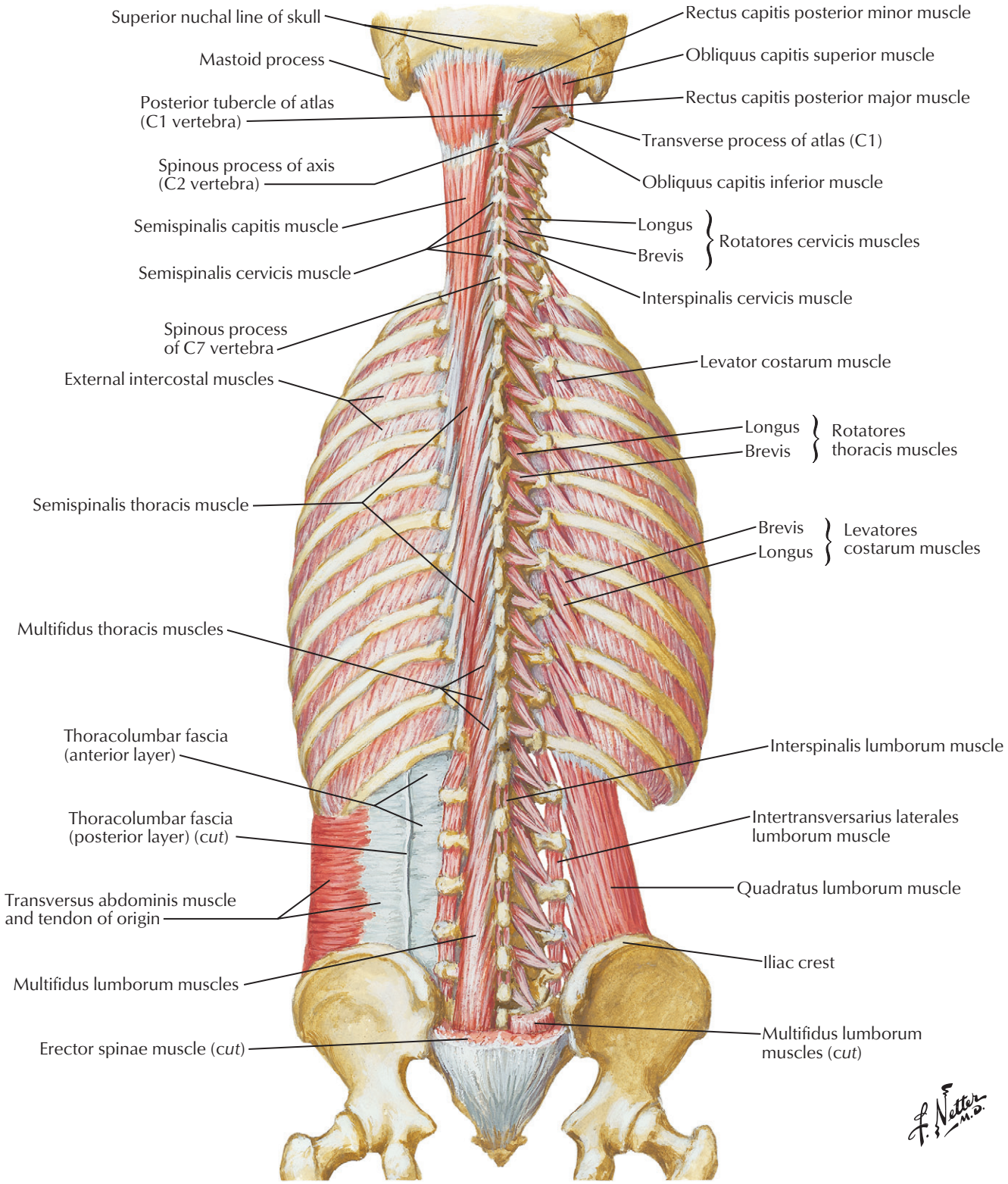

Superior bulb of right internal jugular vein
Condylar emissary vein
Vertebral arteries
Dura mater
Mastoid emissary vein
Anterior internal (epidural) vertebral venous plexus
Venous plexus around vertebral artery
Anterior external vertebral venous plexus
Communicating veins
Anterior vertebral veins
Left deep cervical vein
Right deep cervical vein
Left vertebral vein
Left vertebral artery
Accessory vertebral vein
Left thyrocervical trunk
Right vertebral artery and vein
Left internal jugular vein (inferior bulb)
Dorsal scapular artery
Left subclavian artery
Costocervical trunk
Left subclavian vein
Right thyrocervical trunk
Left brachiocephalic vein
Right subclavian vein
Left common carotid artery
Right internal jugular vein (inferior bulb)
Right brachiocephalic vein
Right subclavian artery
Right common carotid artery
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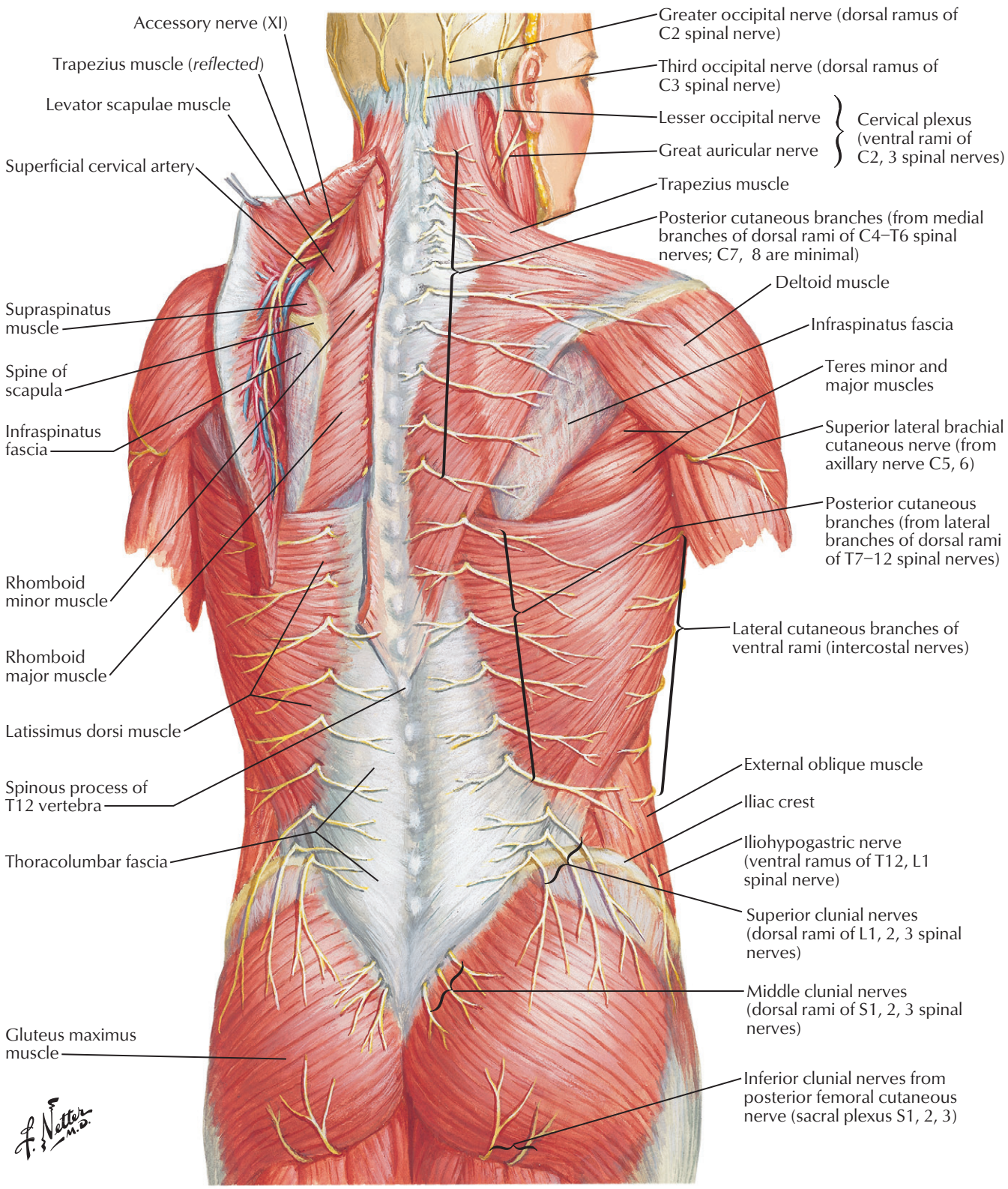
Muscles of Back: Superficial Layers

See also Plates 29, 250



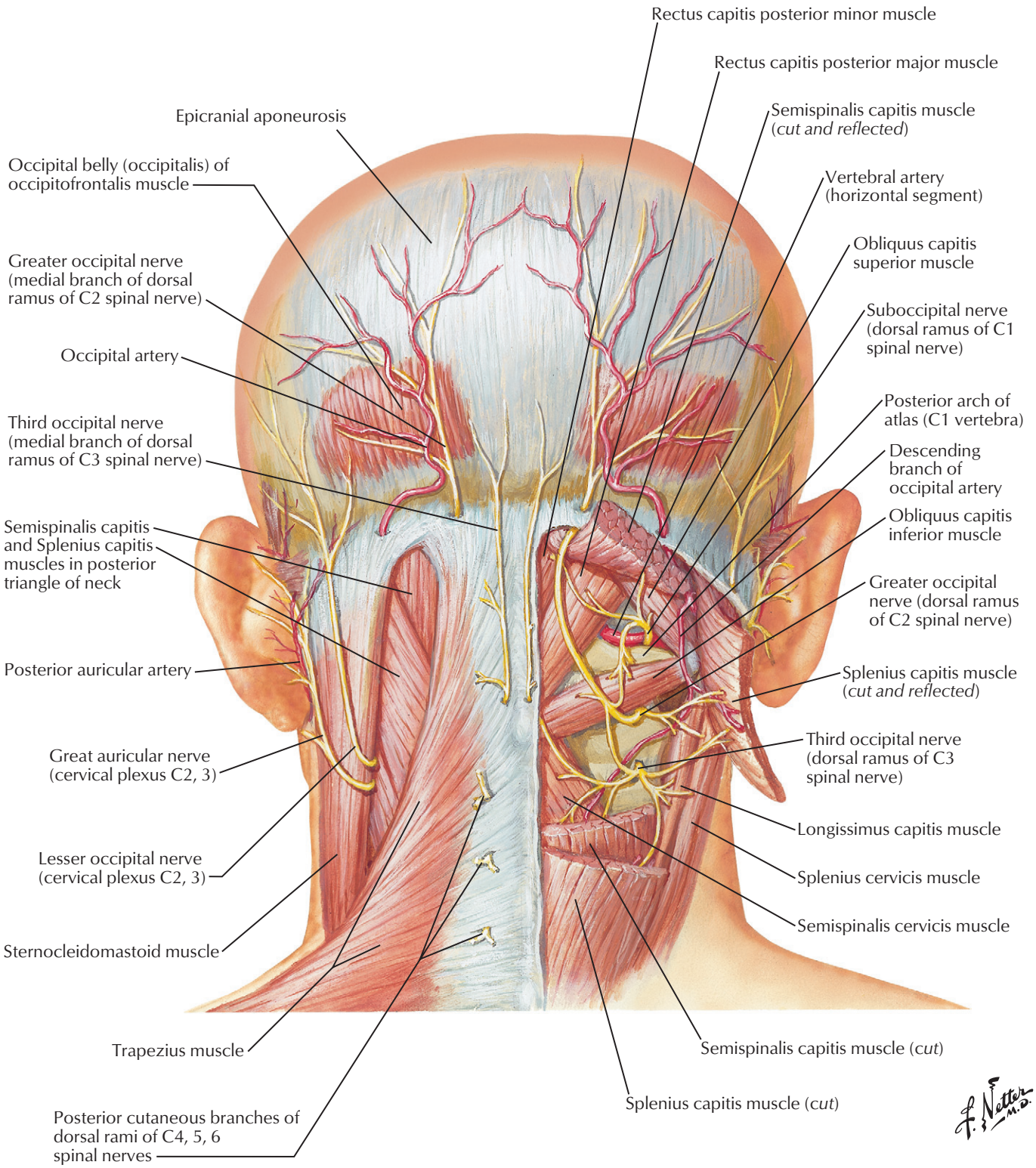

Superior nuchal line of skull
Posterior tubercle of atlas (C1)
Longissimus capitis muscle
Semispinalis capitis muscle
Splenius capitis and splenius cervicis muscles
Serratus posterior superior muscle
Erector spinae muscle
Iliocostalis muscle
Longissimus muscle
Spinalis muscle
Serratus posterior inferior muscle
Tendon of origin of transversus abdominis muscle
Internal oblique muscle
External oblique muscle (cut)
Iliac crest
Rectus capitis posterior minor muscle
Obliquus capitis superior muscle
Rectus capitis posterior major muscle
Obliquus capitis inferior muscle
Longissimus capitis muscle
Semispinalis capitis muscle (cut)
Spinalis cervicis muscle
Spinous process of C7 vertebra
Longissimus cervicis muscle
Iliocostalis cervicis muscle
Iliocostalis thoracis muscle
Hook
Spinalis thoracis muscle
Longissimus thoracis muscle
Iliocostalis lumborum muscle
Spinous process of T12 vertebra
Transversus abdominis muscle and tendon of origin
Thoracolumbar fascia (posterior layer) (cut)

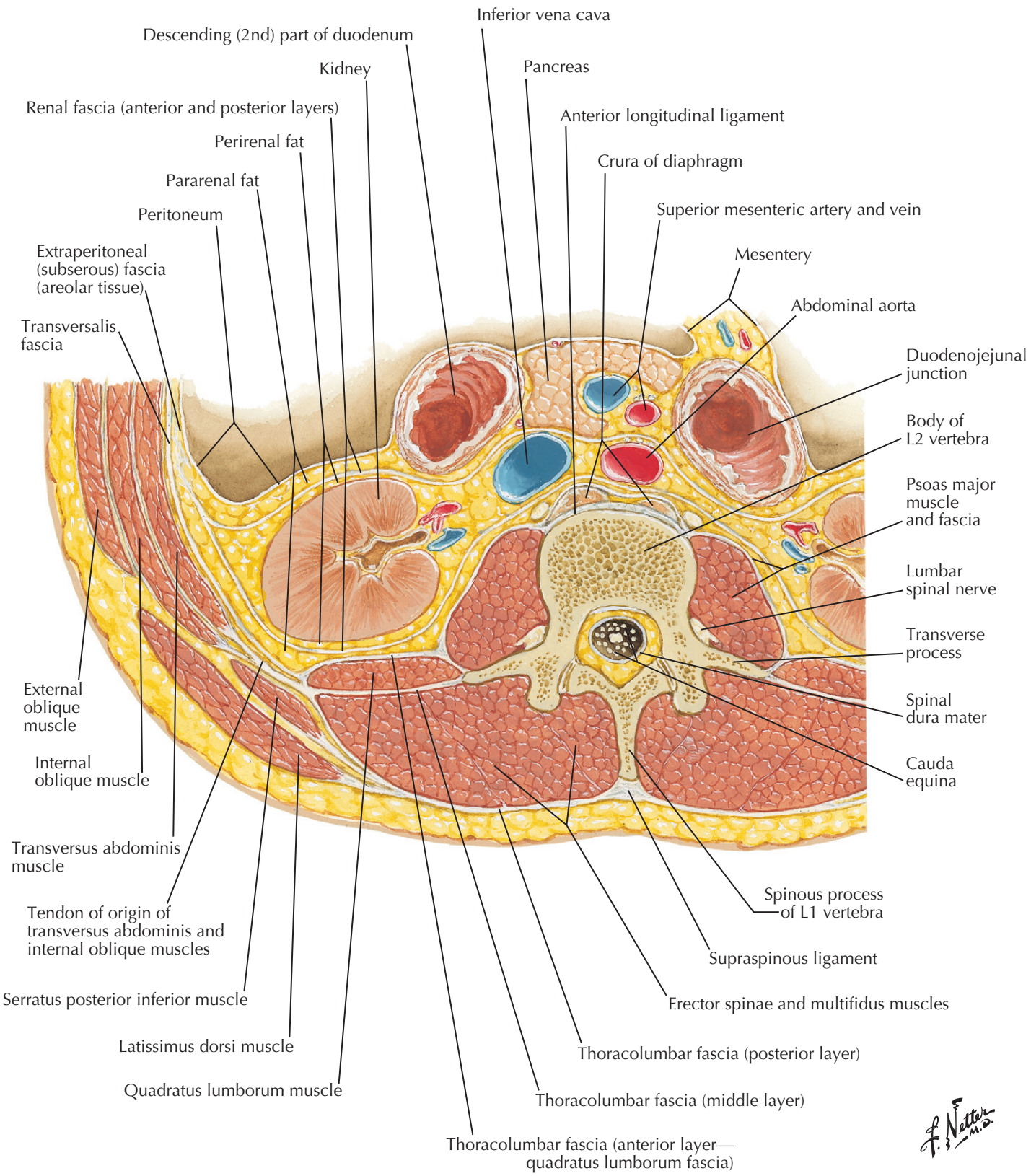

Superior nuchal line of skull
Mastoid process
Posterior tubercle of atlas (C1 vertebra)
Spinous process of axis (C2 vertebra)
Semispinalis capitis muscle
Semispinalis cervicis muscle
Spinous process of C7 vertebra
External intercostal muscles
Semispinalis thoracis muscle
Multifidus thoracis muscles
Thoracolumbar fascia (anterior layer)
Thoracolumbar fascia (posterior layer) (cut)
Transversus abdominis muscle and tendon of origin
Multifidus lumborum muscles
Erector spinae muscle (cut)
Rectus capitis posterior minor muscle
Obliquus capitis superior muscle
Rectus capitis posterior major muscle
Transverse process of atlas (C1)
Obliquus capitis inferior muscle
Longus
Brevis
Rotatores cervicis muscles
Interspinalis cervicis muscle
Levator costarum muscle
Longus
Brevis
Rotatores thoracis muscles
Brevis
Longus
Levatores costarum muscles
Interspinalis lumborum muscle
Intertransversarius laterales lumborum muscle
Quadratus lumborum muscle
Iliac crest
Multifidus lumborum muscles (cut)


Accessory nerve (XI)
Trapezius muscle (*reflected*)
Levator scapulae muscle
Superficial cervical artery
Supraspinatus muscle
Spine of scapula
Infraspinatus fascia
Rhomboid minor muscle
Rhomboid major muscle
Latissimus dorsi muscle
Spinous process of T12 vertebra
Thoracolumbar fascia
Gluteus maximus muscle
Greater occipital nerve (dorsal ramus of C2 spinal nerve)
Third occipital nerve (dorsal ramus of C3 spinal nerve)
Lesser occipital nerve
Great auricular nerve
Cervical plexus (ventral rami of C2, 3 spinal nerves)
Trapezius muscle
Posterior cutaneous branches (from medial branches of dorsal rami of C4–T6 spinal nerves; C7, 8 are minimal)
Deltoid muscle
Infraspinatus fascia
Teres minor and major muscles
Superior lateral brachial cutaneous nerve (from axillary nerve C5, 6)
Posterior cutaneous branches (from lateral branches of dorsal rami of T7–12 spinal nerves)
Lateral cutaneous branches of ventral rami (intercostal nerves)
External oblique muscle
Iliac crest
Iliohypogastric nerve (ventral ramus of T12, L1 spinal nerve)
Superior clunial nerves (dorsal rami of L1, 2, 3 spinal nerves)
Middle clunial nerves (dorsal rami of S1, 2, 3 spinal nerves)
Inferior clunial nerves from posterior femoral cutaneous nerve (sacral plexus S1, 2, 3)

Suboccipital Triangle

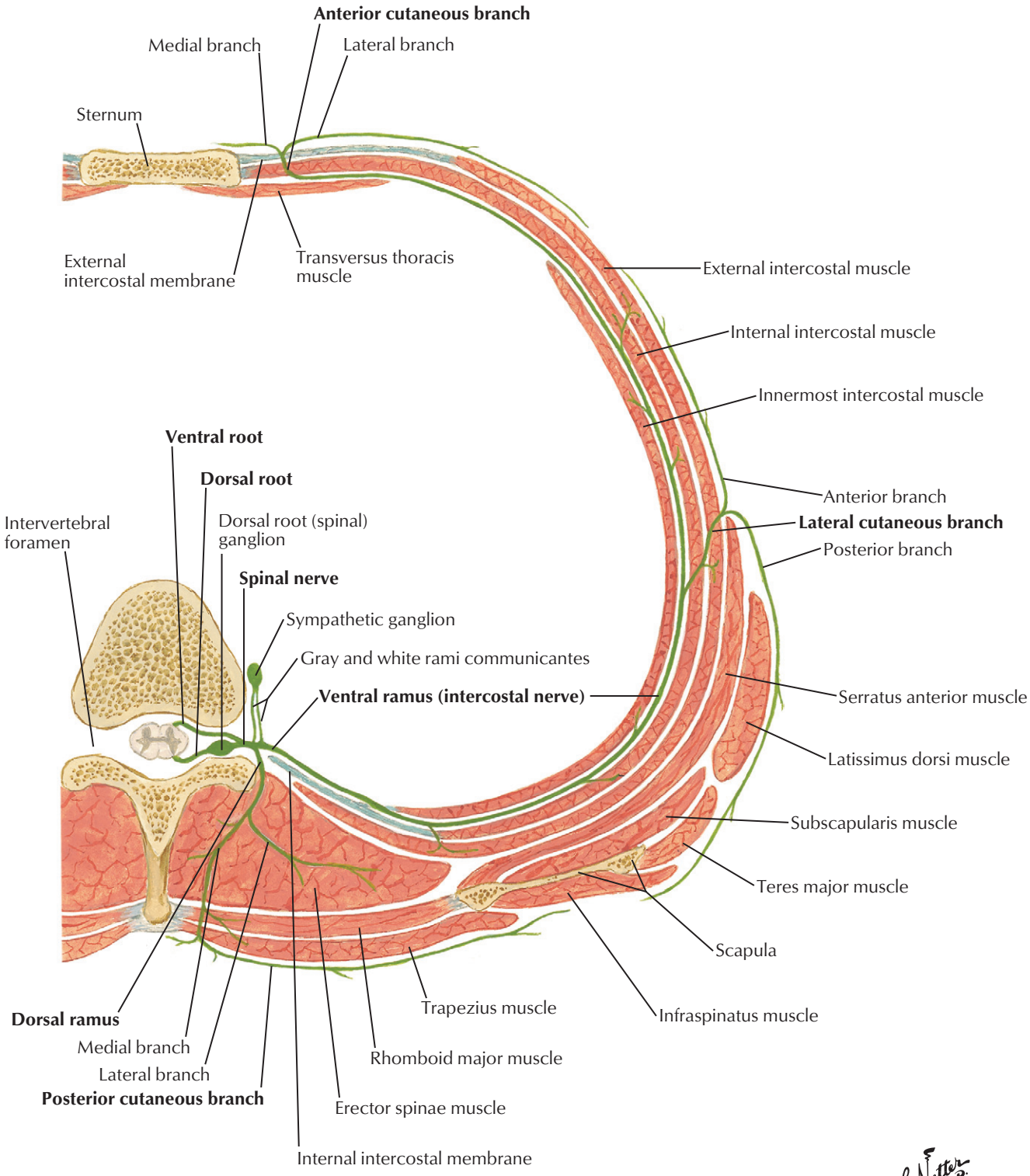
See also Plates 29, 32




Inferior vena cava
Descending (2nd) part of duodenum
Kidney
Pancreas
Renal fascia (anterior and posterior layers)
Anterior longitudinal ligament
Perirenal fat
Crura of diaphragm
Pararenal fat
Superior mesenteric artery and vein
Peritoneum
Mesentery
Extraperitoneal (subserous) fascia (areolar tissue)
Abdominal aorta
Transversalis fascia
Duodenojejunal junction
Body of L2 vertebra
Psoas major muscle and fascia
Lumbar spinal nerve
Transverse process
External oblique muscle
Spinal dura mater
Internal oblique muscle
Cauda equina
Transversus abdominis muscle
Spinous process of L1 vertebra
Tendon of origin of transversus abdominis and internal oblique muscles
Supraspinous ligament
Serratus posterior inferior muscle
Erector spinae and multifidus muscles
Latissimus dorsi muscle
Thoracolumbar fascia (posterior layer)
Quadratus lumborum muscle
Thoracolumbar fascia (middle layer)
Thoracolumbar fascia (anterior layer—quadratus lumborum fascia)

Typical Thoracic Spinal Nerve: Cross Section

See also Plate 254

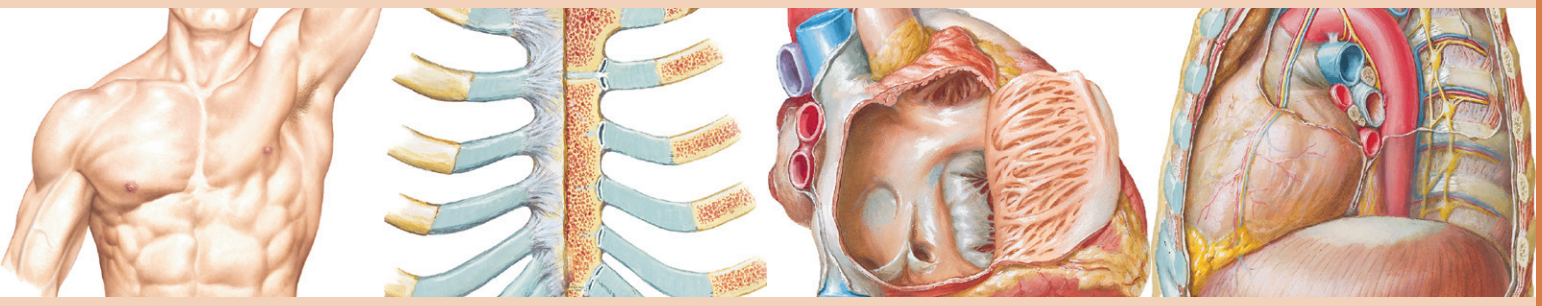


Note: *In lower thoracic region, lateral branch of dorsal ramus is longer, motor, and cutaneous; medial branch is shorter and motor only.*

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Erector spinae	Posterior sacrum, iliac crest, sacrospinous ligament, supraspinous ligament, spinous processes of lower lumbar and sacral vertebrae	*Iliocostalis:* angles of lower ribs, cervical transverse processes *Longissimus:* between tubercles and angles of ribs, transverse processes of thoracic and cervical vertebrae, mastoid process *Spinalis:* spinous processes of upper thoracic and midcervical vertebrae	Dorsal rami of each region	Extends and laterally bends vertebral column and head	*Cervical portions:* occipital, deep cervical, and vertebral arteries *Thoracic portions:* dorsal branches of posterior intercostal, subcostal, and lumbar arteries *Sacral portions:* dorsal branches of lateral sacral arteries	Sacrospinalis
Interspinales (cervical, thoracic, lumbar)	Spinous process	Adjacent spinous process	Dorsal rami of spinal nerves	Aid in extension of vertebral column	*Cervical portions:* occipital, deep cervical, and vertebral arteries *Thoracic portions:* dorsal branches of posterior intercostal arteries *Lumbar portions:* dorsal branches of lumbar arteries	Segmental
Intertransversarii (cervical, thoracic, lumbar)	Extend between adjacent transverse processes of vertebrae	Extend between adjacent transverse processes of vertebrae	Dorsal rami of spinal nerves	Assist in lateral flexion of vertebral column	*Cervical portions:* occipital, deep cervical, and vertebral arteries *Thoracic portions:* dorsal branches of posterior intercostal, subcostal, and lumbar arteries *Lumbar portions:* dorsal branches of lateral lumbar arteries	Segmental
Latissimus dorsi	Spinous processes of T7–L5, thoracolumbar fascia, iliac crest, and last three ribs	Humerus (intertubercular sulcus)	Thoracodorsal nerve	Extends, adducts, and medially rotates humerus	Thoracodorsal artery, dorsal perforating branches of 9th, 10th, and 11th posterior intercostal, subcostal, and first three lumbar arteries	Superficial back
Levator scapulae	Posterior tubercles of transverse processes of C1–C4	Medial border of scapula from superior angle to spine	Ventral rami of C3–C4 and dorsal scapular nerve	Elevates scapula medially, inferiorly rotates glenoid cavity	Dorsal scapular artery, transverse cervical artery, ascending cervical artery	Superficial back
Multifidus	Sacrum, ilium, transverse processes of T1–T12, and articular processes of C4–C7	Spinous processes of vertebrae above, spanning two to four segments	Dorsal rami of each region	Stabilizes spine	*Cervical portions:* occipital, deep cervical, and vertebral arteries *Thoracic portions:* dorsal branches of posterior intercostal, subcostal, and lumbar arteries *Sacral portions:* dorsal branches of lateral sacral arteries	Transversospinalis
Obliquus capitis inferior	Spine of axis	Transverse process of atlas	Suboccipital nerve	Rotates atlas to turn face to same side	Vertebral artery, descending branch of occipital artery	Suboccipital
Obliquus capitis superior	Transverse process of atlas	Occipital bone	Suboccipital nerve	Extends and bends head laterally	Vertebral artery, descending branch of occipital artery	Suboccipital
Rectus capitis posterior major	Spine of axis	Inferior nuchal line	Suboccipital nerve	Extends and rotates head to same side	Vertebral artery, descending branch of occipital artery	Suboccipital

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Rectus capitis posterior minor	Tubercle of posterior arch of atlas	Median inferior nuchal line	Suboccipital nerve	Extends head	Vertebral artery, descending branch of occipital artery	Suboccipital
Rhomboid major	Spinous processes of T2–T5 vertebrae	Medial border of scapula below base of spine of scapula	Dorsal scapular nerve	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid cavity	Dorsal scapular artery *OR* deep branch of transverse cervical artery, dorsal perforating branches of the upper five or six posterior intercostal arteries	Superficial back
Rhomboid minor	Ligamentum nuchae, spines of C7 and T1 vertebrae	Medial border of scapula at spine of scapula	Dorsal scapular nerve	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid cavity	Dorsal scapular artery *OR* deep branch of transverse cervical artery, dorsal perforating branches of the upper five or six posterior intercostal arteries	Superficial back
Rotatores	Transverse processes of cervical, thoracic, and lumbar regions	Lamina and transverse process of spine above, spanning one or two segments	Dorsal rami of spinal nerves	Stabilizes, extends, and rotates spine	Dorsal branches of segmental arteries	Transversospinalis
Semispinalis	Transverse processes of C4–T12	Spinous processes of cervical and thoracic regions	Dorsal rami of spinal nerves	Extends head, neck, and thorax and rotates them to opposite side	*Cervical portions:* occipital, deep cervical, and vertebral arteries *Thoracic portions:* dorsal branches of posterior intercostal arteries	Transversospinalis
Serratus posterior inferior	Spinous processes of T11–L2	Inferior aspect of ribs 9–12	Ventral rami of lower thoracic nerves	Depresses ribs	Posterior intercostal arteries	Intermediate back
Serratus posterior superior	Ligamentum nuchae, spinous processes of C7–T3	Superior aspect of ribs 2–4	Ventral rami of upper thoracic nerves	Elevates ribs	Posterior intercostal arteries	Intermediate back
Splenius capitis	Nuchal ligament, spinous process of C7–T3	Mastoid process of temporal bone, lateral third of superior nuchal line	Dorsal rami of middle cervical nerves	*Bilaterally:* extend head *Unilaterally*: laterally bends (flexes) and rotates face to same side	Descending branch of occipital artery, deep cervical artery	Spinotransverse
Splenius cervicis	Spinous process of T3–T6	Transverse processes (C1–C3)	Dorsal rami of lower cervical nerves	*Bilaterally*: extend neck *Unilaterally:* laterally bends (flexes) and rotates neck toward same side	Descending branch of occipital artery, deep cervical artery	Spinotransverse
Trapezius	Superior nuchal line, external occipital protuberance, nuchal ligament, spinous processes of C7–T12	Lateral third of clavicle, acromion, spine of scapula	Accessory nerve (CN XI)	Elevates, retracts, and rotates scapula; lower fibers depress scapula	Transverse cervical artery, dorsal perforating branches of posterior intercostal arteries	Superficial back



Section

3 THORAX

Topographic Anatomy
Plate 178

178 Thorax: Surface Anatomy

Mammary Gland
Plates 179–182

179 Mammary Gland

180 Arteries of Mammary Gland

181 Lymph Vessels and Nodes of Mammary Gland

182 Lymphatic Drainage of Breast

Body Wall
Plates 183–192

183 Bony Framework of Thorax

184 Ribs and Associated Joints

185 Anterior Thoracic Wall

186 Anterior Thoracic Wall (continued)

187 Anterior Thoracic Wall: Internal View

188 Intercostal Nerves and Arteries

189 Veins of Internal Thoracic Wall

190 Phrenic Nerve

191 Diaphragm: Thoracic Surface

192 Diaphragm: Abdominal Surface

Lungs
Plates 193–207

193 Topography of Lungs: Anterior View

194 Topography of Lungs: Posterior View

195 Lungs in Situ: Anterior View
196 Lungs: Medial Views
197 Bronchopulmonary Segments
198 Bronchopulmonary Segments (continued)
199 Trachea and Major Bronchi
200 Nomenclature of Bronchi: Schema
201 Intrapulmonary Airways: Schema
202 Intrapulmonary Blood Circulation: Schema
203 Great Vessels of Superior Mediastinum
204 Bronchial Arteries and Veins
205 Lymph Vessels and Nodes of Lung
206 Autonomic Nerves in Thorax
207 Innervation of Tracheobronchial Tree: Schema

Heart

Plates 208–226

208 Heart in Situ
209 Heart: Anterior Exposure
210 Radiology and Auscultation of Heart
211 Heart: Base and Diaphragmatic Surface
212 Pericardial Sac
213 Mediastinum: Cross Section
214 Thorax: Coronal Section of Heart, Ascending Aorta
215 Coronary Arteries and Cardiac Veins
216 Coronary Arteries: Imaging
217 Right Atrium and Ventricle
218 Left Atrium and Ventricle
219 Valves and Fibrous Skeleton of Heart
220 Valves and Fibrous Skeleton of Heart (continued)
221 Atria, Ventricles, and Interventricular Septum
222 Conducting System of Heart
223 Nerves of Heart
224 Innervation of Heart: Schema
225 Innervation of Blood Vessels: Schema
226 Prenatal and Postnatal Circulation

Mediastinum

Plates 227–236

227 Mediastinum: Right Lateral View
228 Mediastinum: Left Lateral View
229 Esophagus in Situ
230 Topography and Constrictions of Esophagus
231 Musculature of Esophagus
232 Esophagogastric Junction
233 Arteries of Esophagus
234 Veins of Esophagus
235 Lymph Vessels and Nodes of Esophagus
236 Nerves of Esophagus

Regional Scans

Plate 237

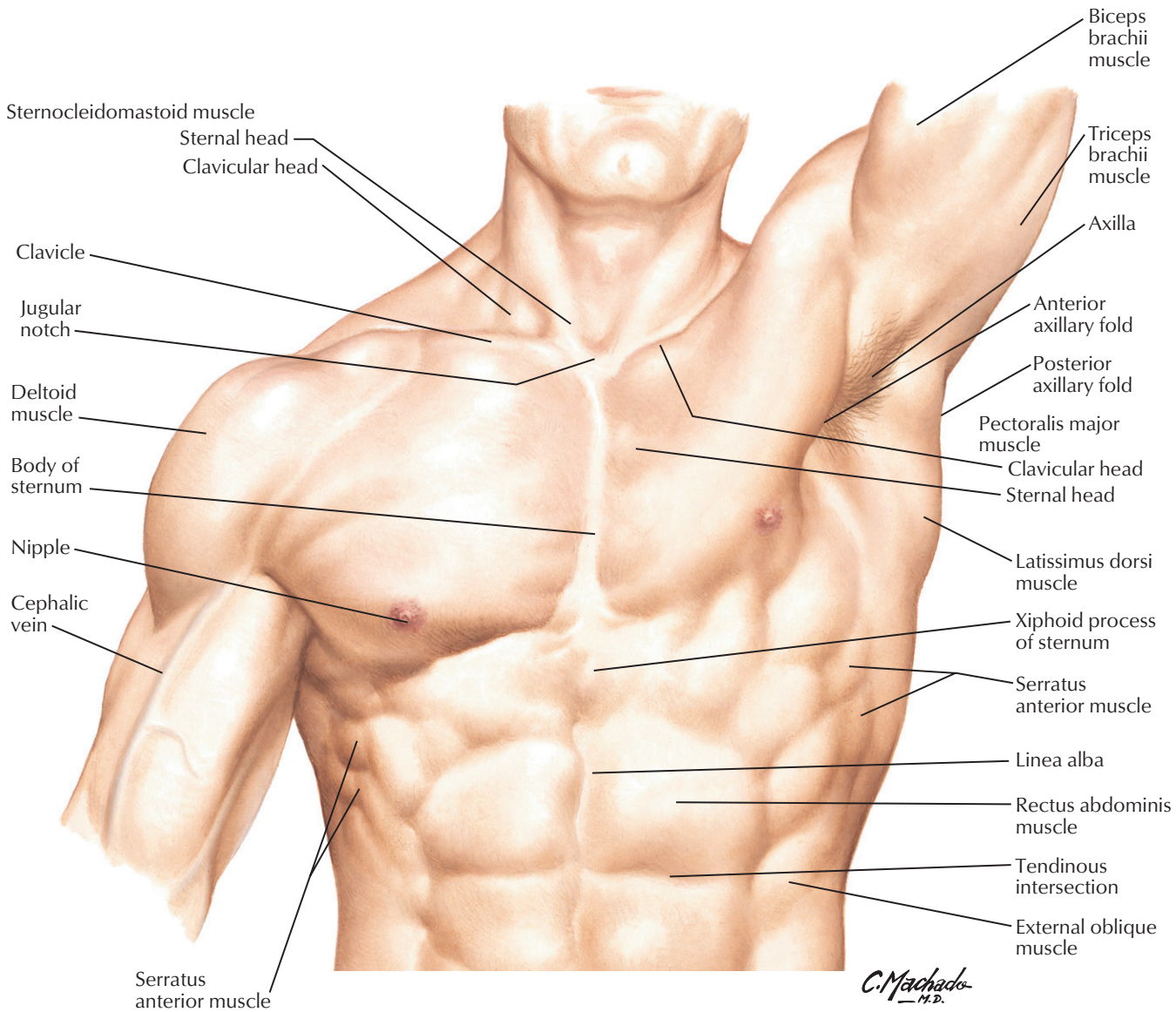
237 Chest Scans: Axial CT Images

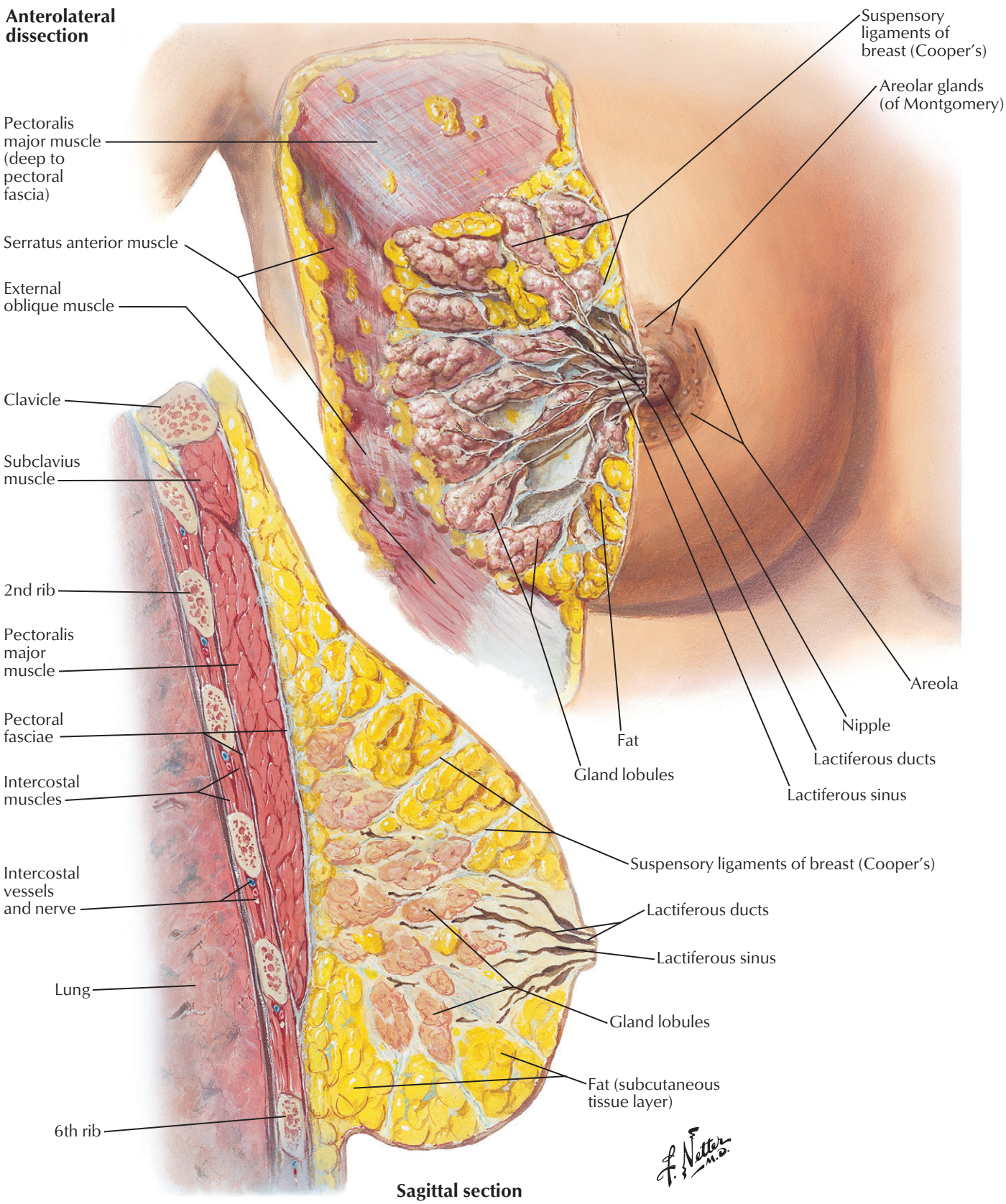
Cross-Sectional Anatomy

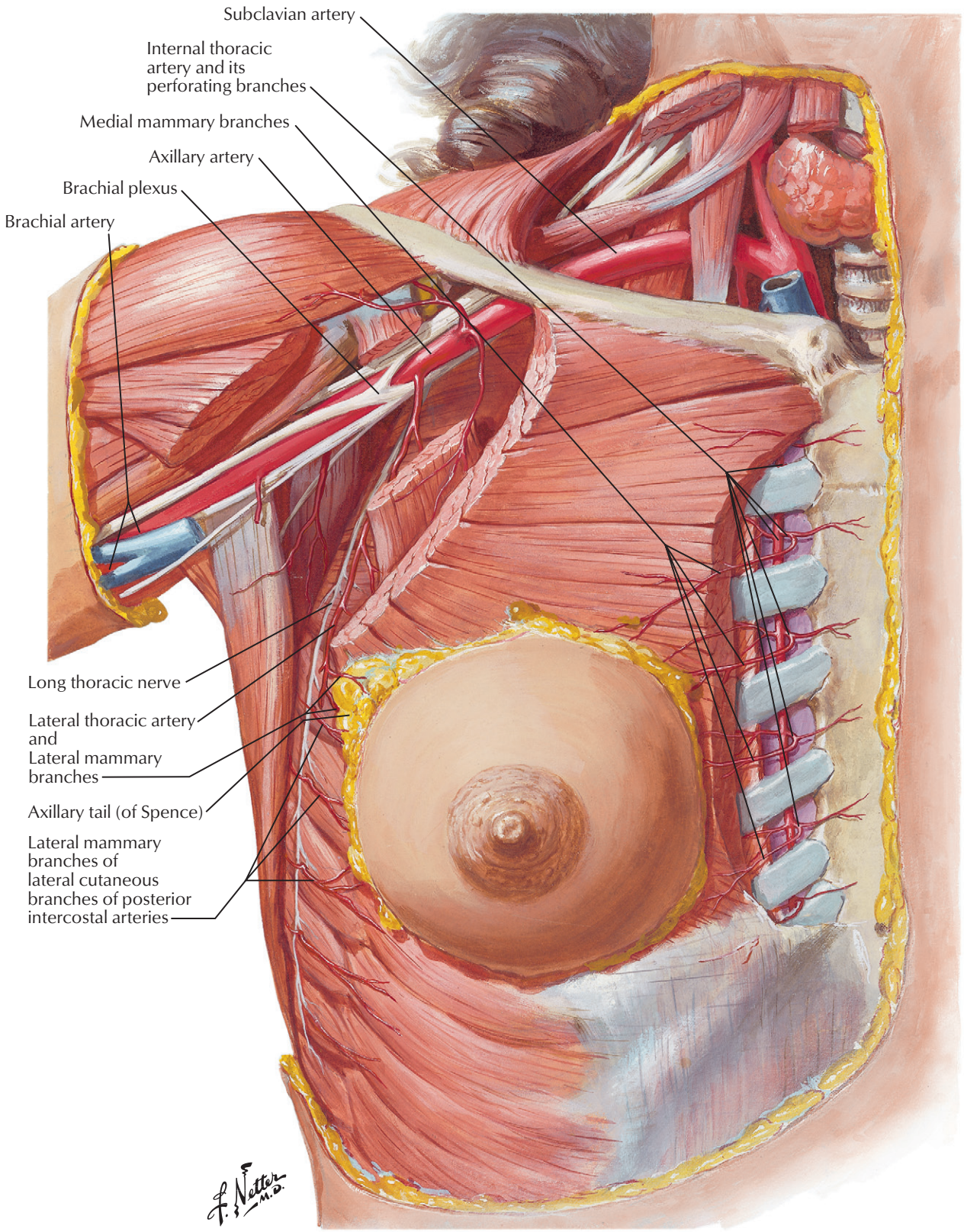
Plates 238–241

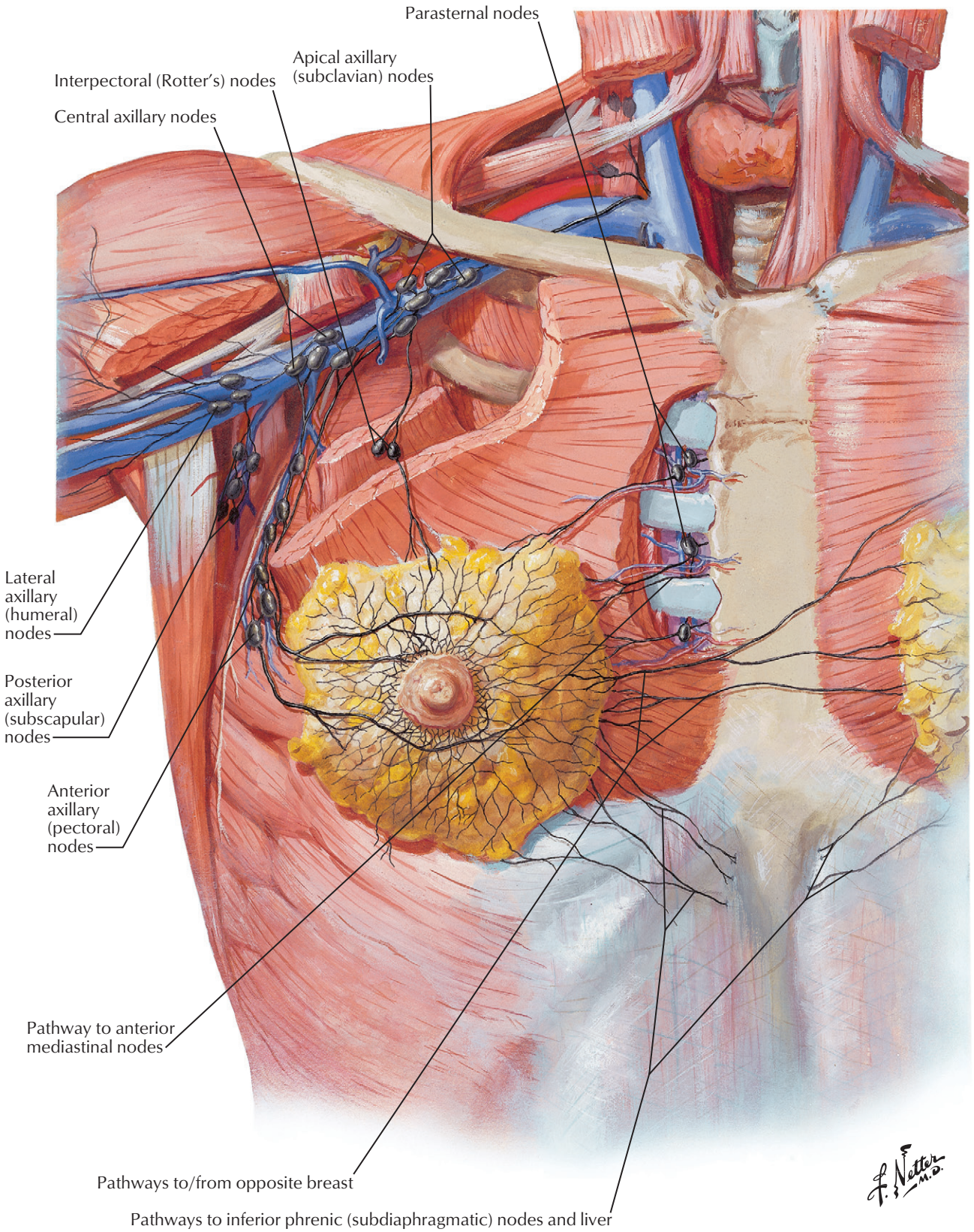
238 Cross Section of Thorax at T3 Level
239 Cross Section of Thorax at T3-4 Disc Level
240 Cross Section of Thorax at T4-5 Disc Level
241 Cross Section of Thorax at T7 Level

Muscle Table


Biceps brachii muscle
Sternocleidomastoid muscle
Sternal head
Clavicular head
Triceps brachii muscle
Axilla
Clavicle
Jugular notch
Anterior axillary fold
Posterior axillary fold
Deltoid muscle
Pectoralis major muscle
Clavicular head
Body of sternum
Sternal head
Nipple
Latissimus dorsi muscle
Cephalic vein
Xiphoid process of sternum
Serratus anterior muscle
Linea alba
Rectus abdominis muscle
Tendinous intersection
External oblique muscle
Serratus anterior muscle
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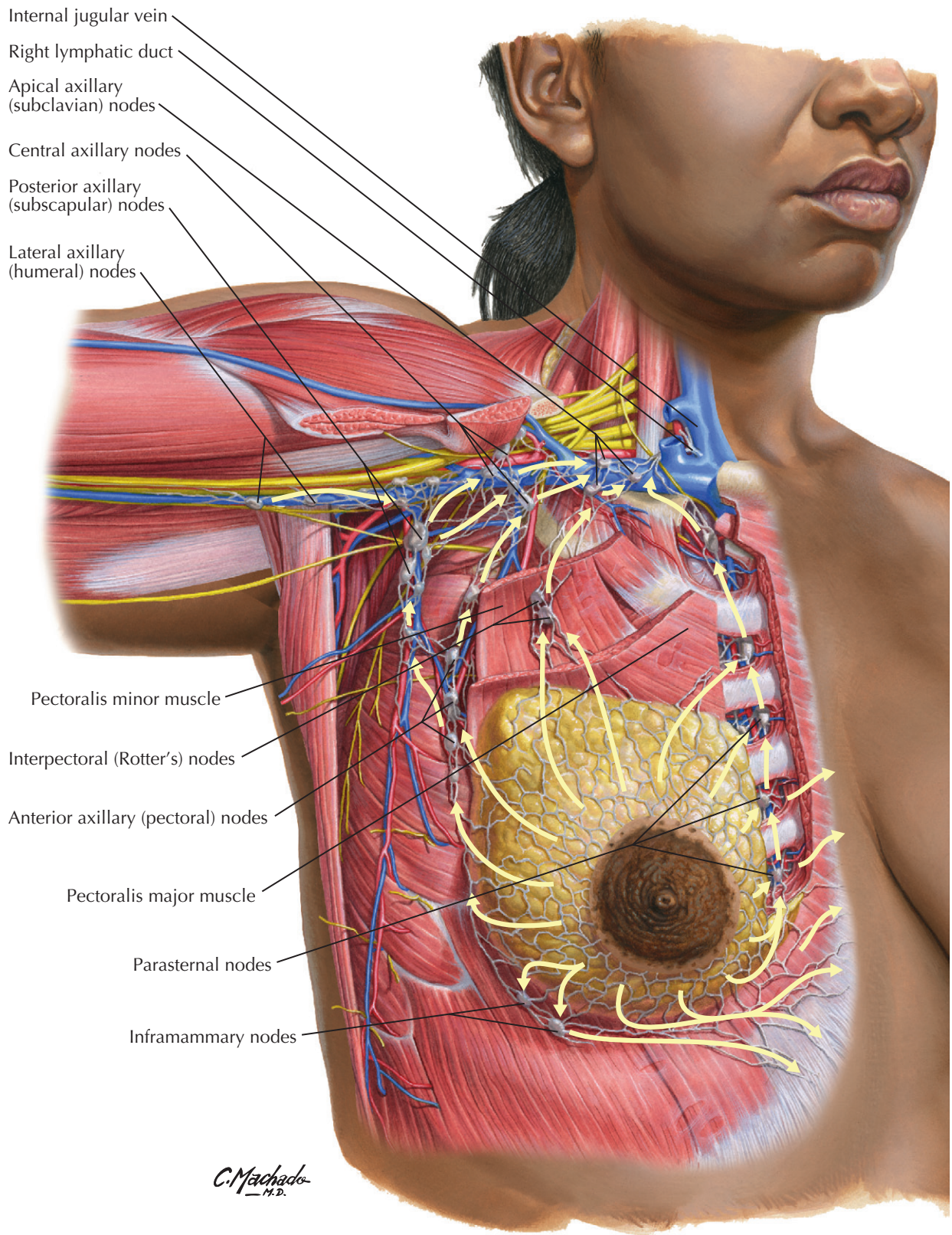

Anterolateral dissection
Pectoralis major muscle (deep to pectoral fascia)
Serratus anterior muscle
External oblique muscle
Clavicle
Subclavius muscle
2nd rib
Pectoralis major muscle
Pectoral fasciae
Intercostal muscles
Intercostal vessels and nerve
Lung
6th rib
Suspensory ligaments of breast (Cooper's)
Areolar glands (of Montgomery)
Areola
Nipple
Lactiferous ducts
Lactiferous sinus
Fat
Gland lobules
Suspensory ligaments of breast (Cooper's)
Lactiferous ducts
Lactiferous sinus
Gland lobules
Fat (subcutaneous tissue layer)
Sagittal section

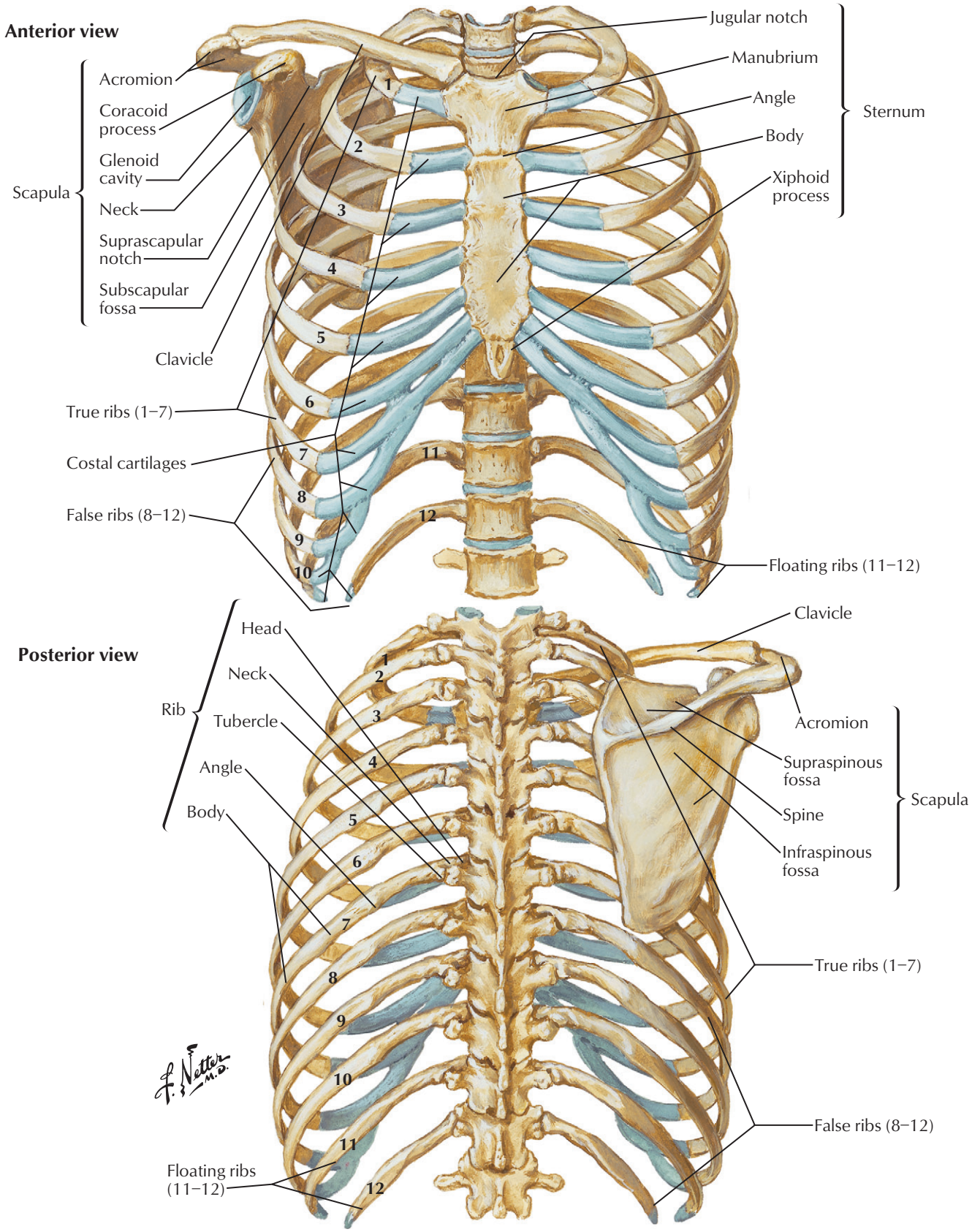

Subclavian artery
Internal thoracic artery and its perforating branches
Medial mammary branches
Axillary artery
Brachial plexus
Brachial artery
Long thoracic nerve
Lateral thoracic artery and Lateral mammary branches
Axillary tail (of Spence)
Lateral mammary branches of lateral cutaneous branches of posterior intercostal arteries
F. Netter M.D.

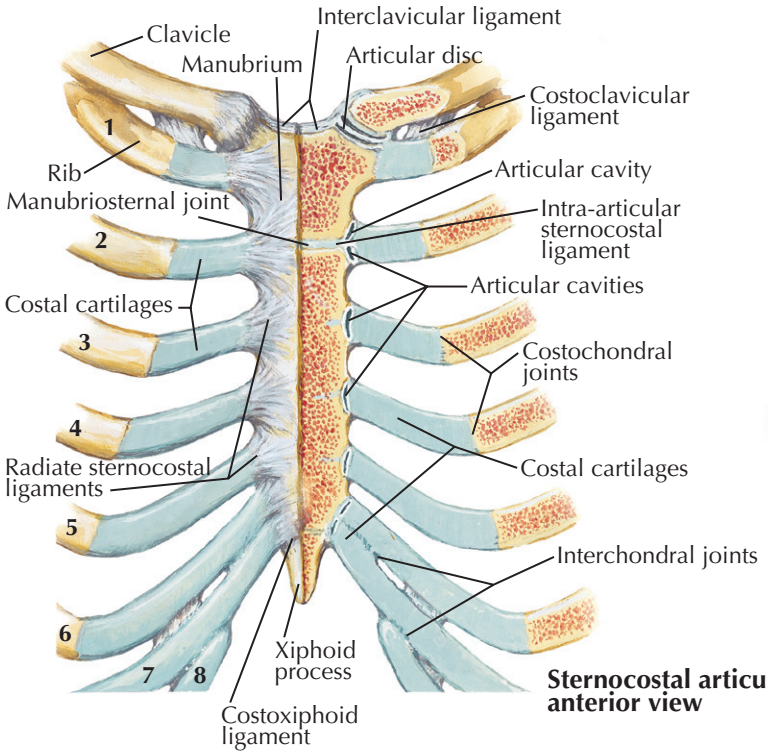

Parasternal nodes
Apical axillary (subclavian) nodes
Interpectoral (Rotter's) nodes
Central axillary nodes
Lateral axillary (humeral) nodes
Posterior axillary (subscapular) nodes
Anterior axillary (pectoral) nodes
Pathway to anterior mediastinal nodes
Pathways to/from opposite breast
Pathways to inferior phrenic (subdiaphragmatic) nodes and liver

Lymphatic Drainage of Breast

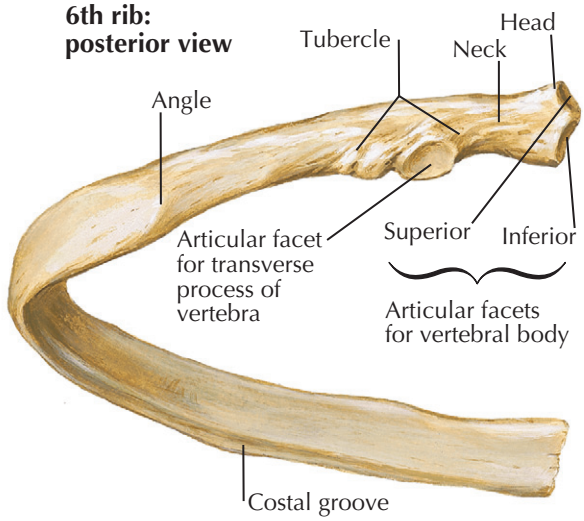
See also Plate 181



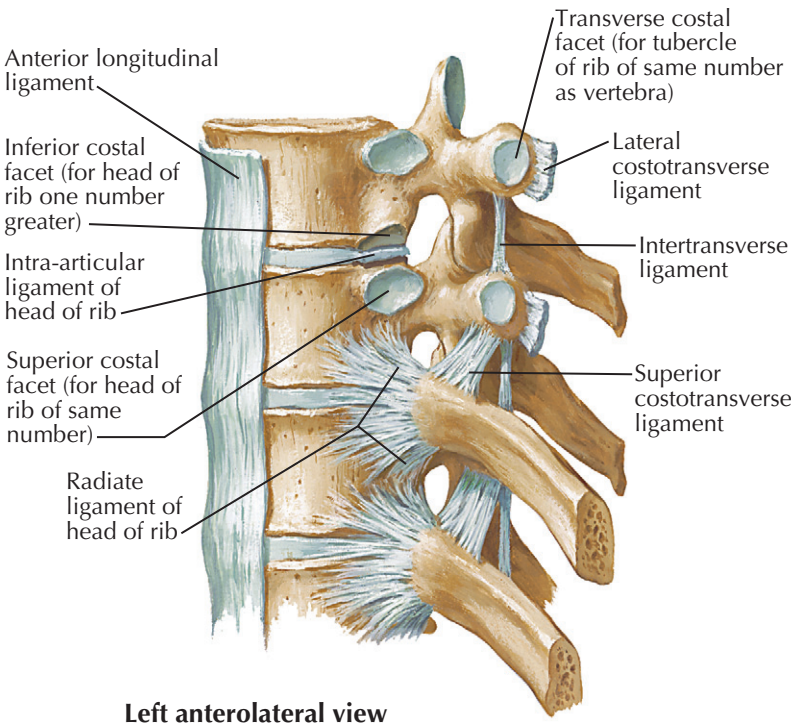

Anterior view
Acromion
Coracoid process
Glenoid cavity
Neck
Suprascapular notch
Subscapular fossa
Scapula
Clavicle
True ribs (1–7)
Costal cartilages
False ribs (8–12)
Jugular notch
Manubrium
Angle
Body
Xiphoid process
Sternum
Floating ribs (11–12)
1
2
3
4
5
6
7
8
9
10
11
12
Posterior view
Head
Neck
Tubercle
Angle
Body
Rib
Clavicle
Acromion
Supraspinous fossa
Spine
Infraspinous fossa
Scapula
True ribs (1–7)
False ribs (8–12)
Floating ribs (11–12)



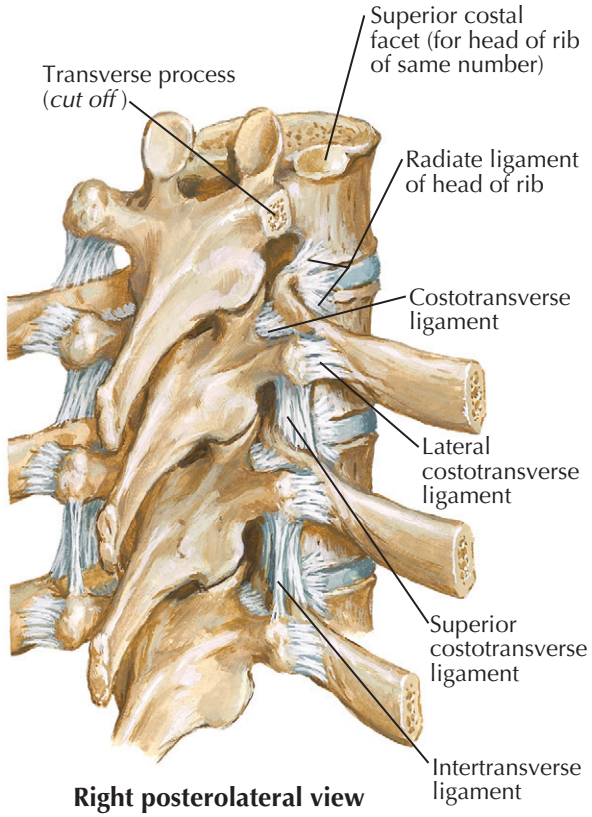
Sternocostal articulations: anterior view



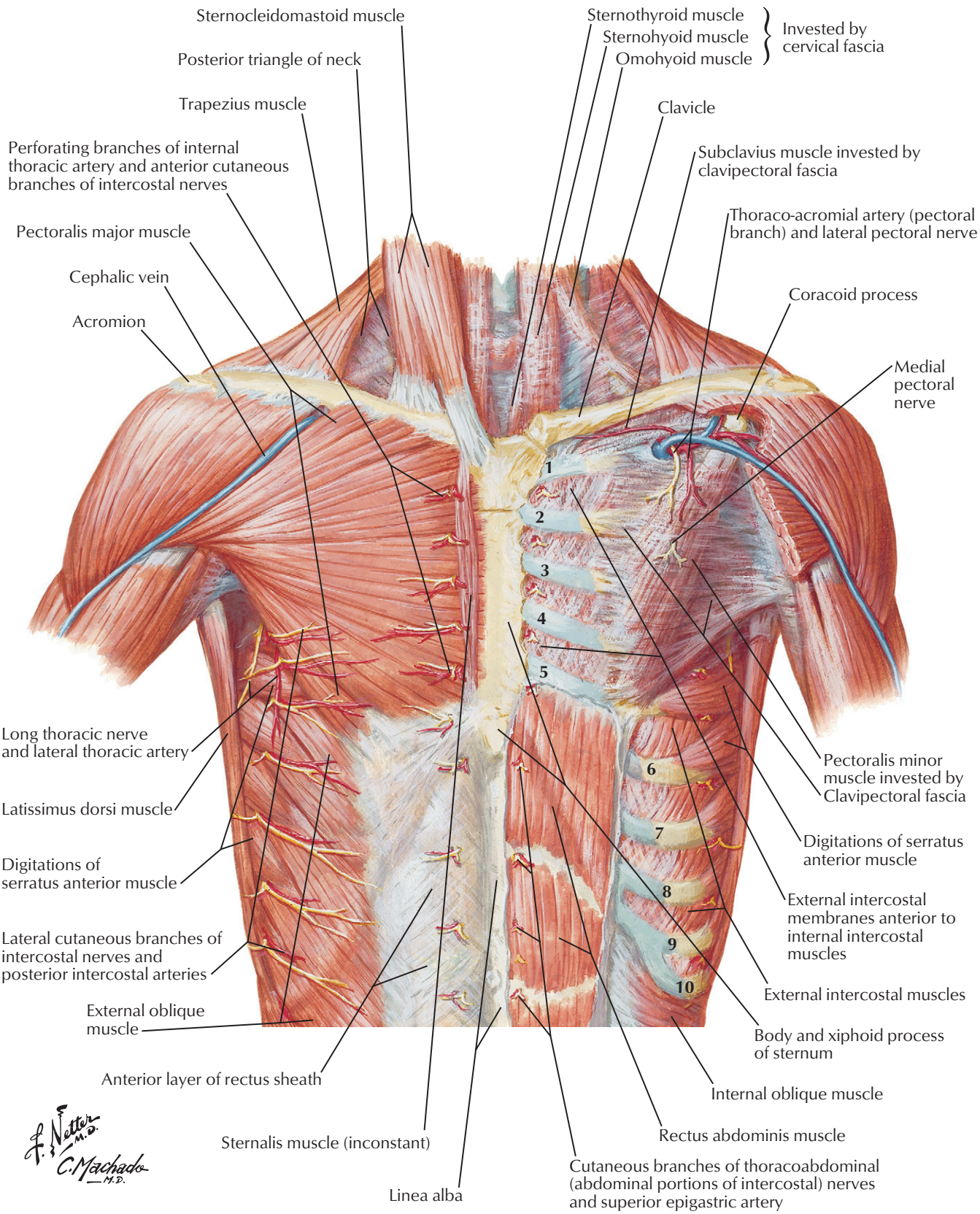
Note: The head of a typical rib articulates with the superior costal facet of the thoracic vertebra of the same number (by its inferior articular facet), the inferior costal facet of the vertebra above (by its superior articular facet), and the intervertebral disc between the two vertebrae. The costal tubercle articulates with the transverse process of the vertebra of the same number.

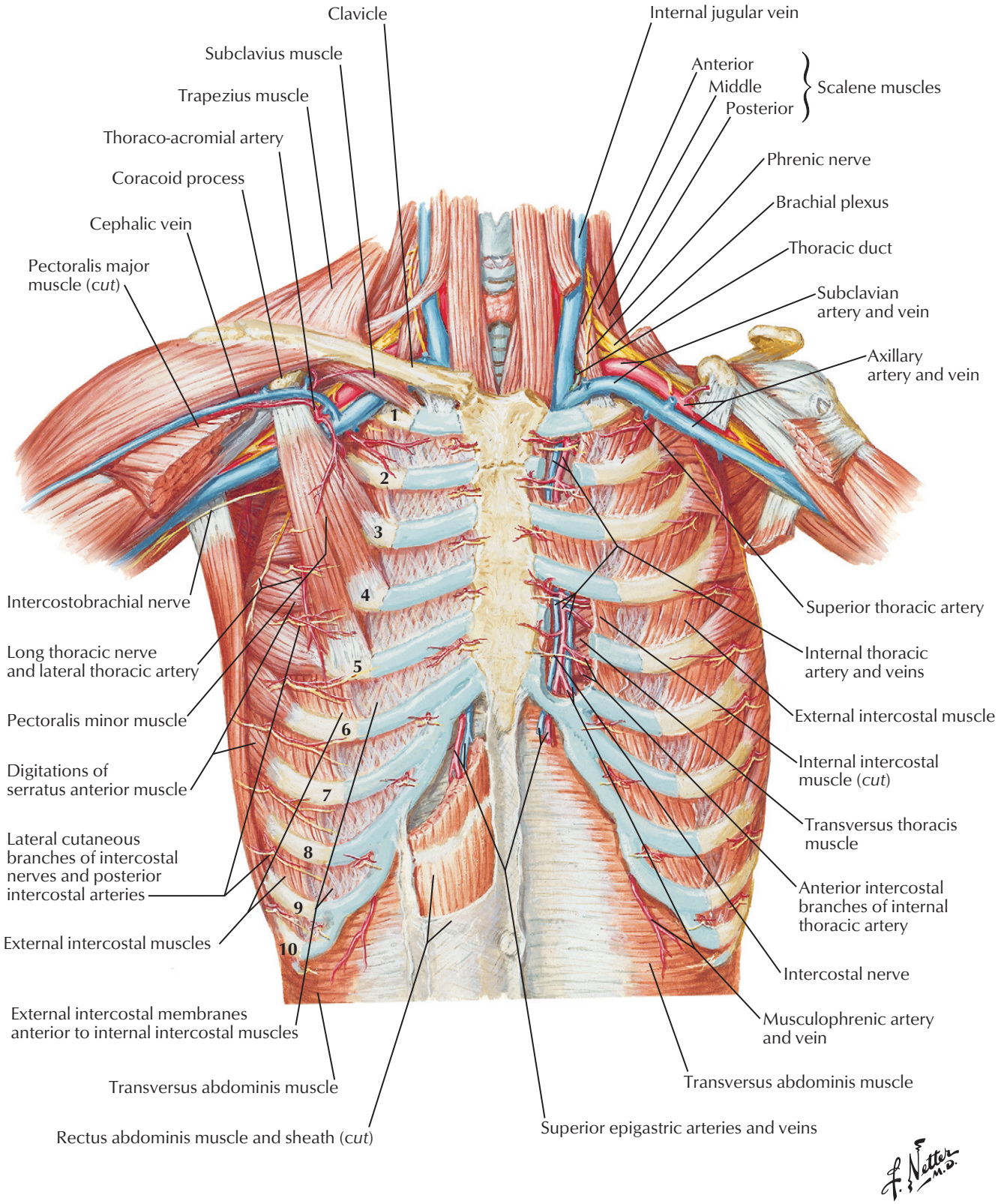


Left anterolateral view

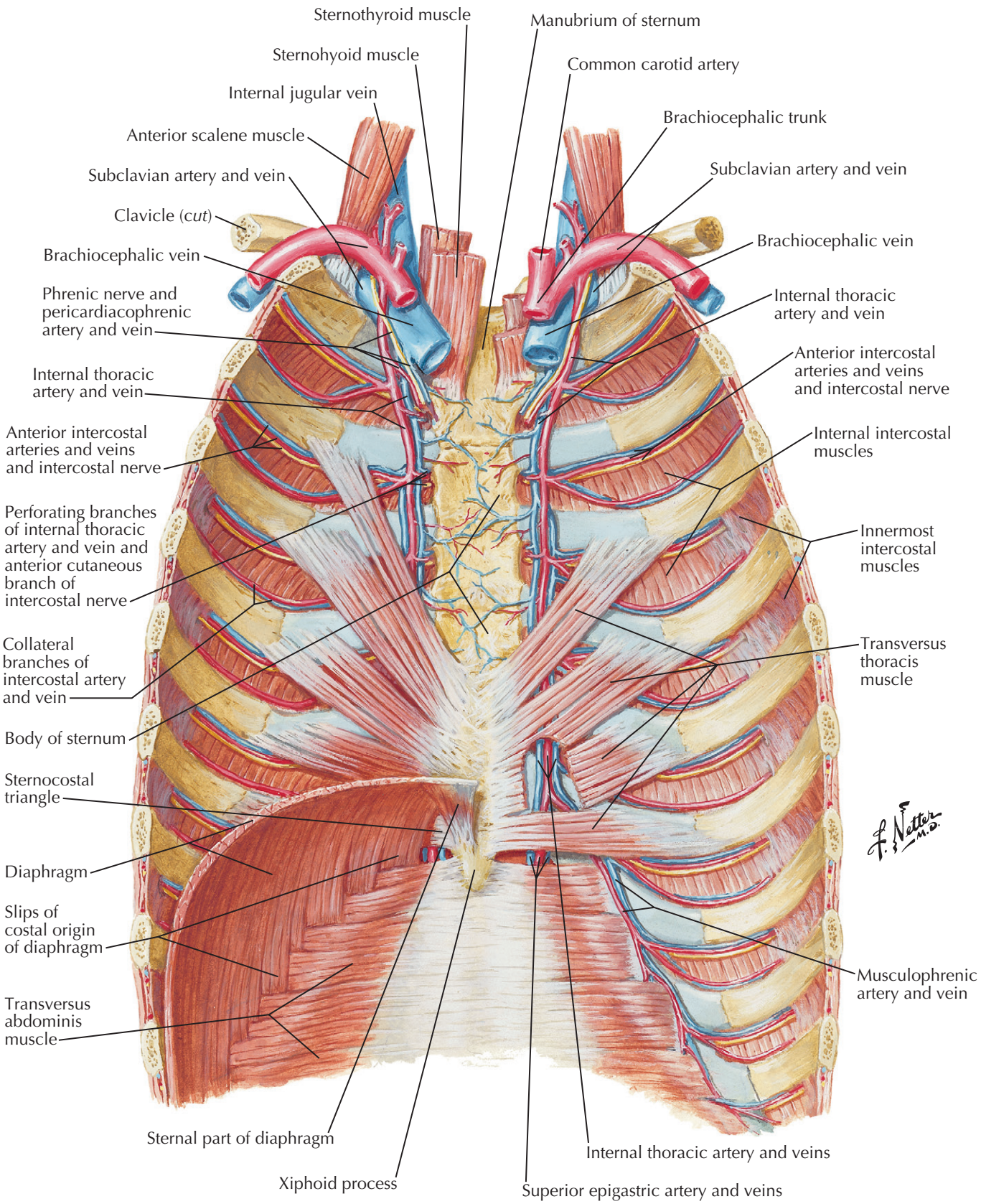


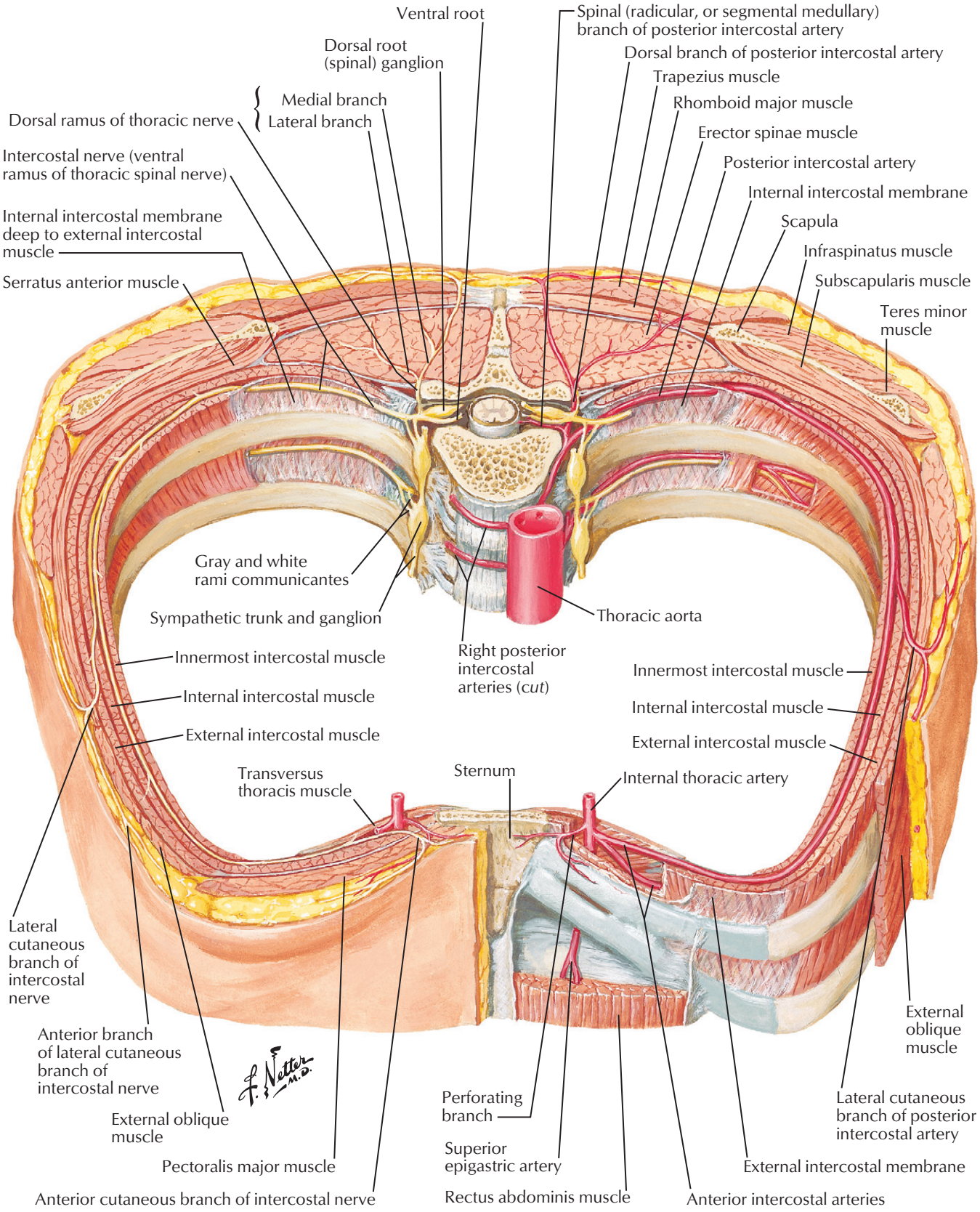
Right posterolateral view


Sternocleidomastoid muscle
Posterior triangle of neck
Trapezius muscle
Perforating branches of internal thoracic artery and anterior cutaneous branches of intercostal nerves
Pectoralis major muscle
Cephalic vein
Acromion
Sternothyroid muscle
Sternohyoid muscle
Omohyoid muscle
Invested by cervical fascia
Clavicle
Subclavius muscle invested by clavipectoral fascia
Thoraco-acromial artery (pectoral branch) and lateral pectoral nerve
Coracoid process
Medial pectoral nerve
1
2
3
4
5
6
7
8
9
10
Long thoracic nerve and lateral thoracic artery
Latissimus dorsi muscle
Digitations of serratus anterior muscle
Lateral cutaneous branches of intercostal nerves and posterior intercostal arteries
External oblique muscle
Anterior layer of rectus sheath
Sternalis muscle (inconstant)
Linea alba
Pectoralis minor muscle invested by Clavipectoral fascia
Digitations of serratus anterior muscle
External intercostal membranes anterior to internal intercostal muscles
External intercostal muscles
Body and xiphoid process of sternum
Internal oblique muscle
Rectus abdominis muscle
Cutaneous branches of thoracoabdominal (abdominal portions of intercostal) nerves and superior epigastric artery


Clavicle
Subclavius muscle
Trapezius muscle
Thoraco-acromial artery
Coracoid process
Cephalic vein
Pectoralis major muscle (cut)
Intercostobrachial nerve
Long thoracic nerve and lateral thoracic artery
Pectoralis minor muscle
Digitations of serratus anterior muscle
Lateral cutaneous branches of intercostal nerves and posterior intercostal arteries
External intercostal muscles
External intercostal membranes anterior to internal intercostal muscles
Transversus abdominis muscle
Rectus abdominis muscle and sheath (cut)
Internal jugular vein
Anterior
Middle
Posterior
Scalene muscles
Phrenic nerve
Brachial plexus
Thoracic duct
Subclavian artery and vein
Axillary artery and vein
Superior thoracic artery
Internal thoracic artery and veins
External intercostal muscle
Internal intercostal muscle (cut)
Transversus thoracis muscle
Anterior intercostal branches of internal thoracic artery
Intercostal nerve
Musculophrenic artery and vein
Transversus abdominis muscle
Superior epigastric arteries and veins
1
2
3
4
5
6
7
8
9
10

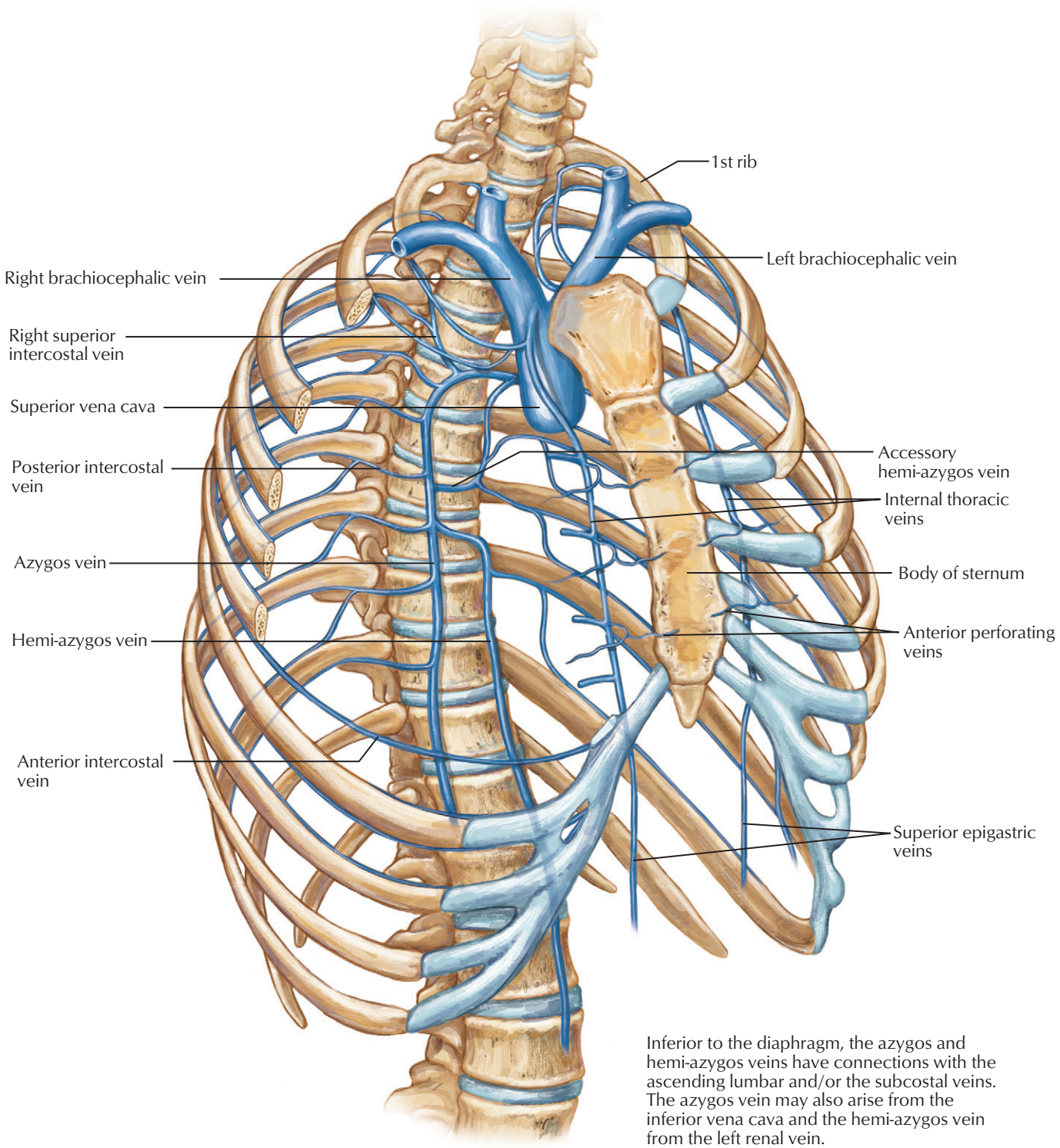
Anterior Thoracic Wall: Internal View



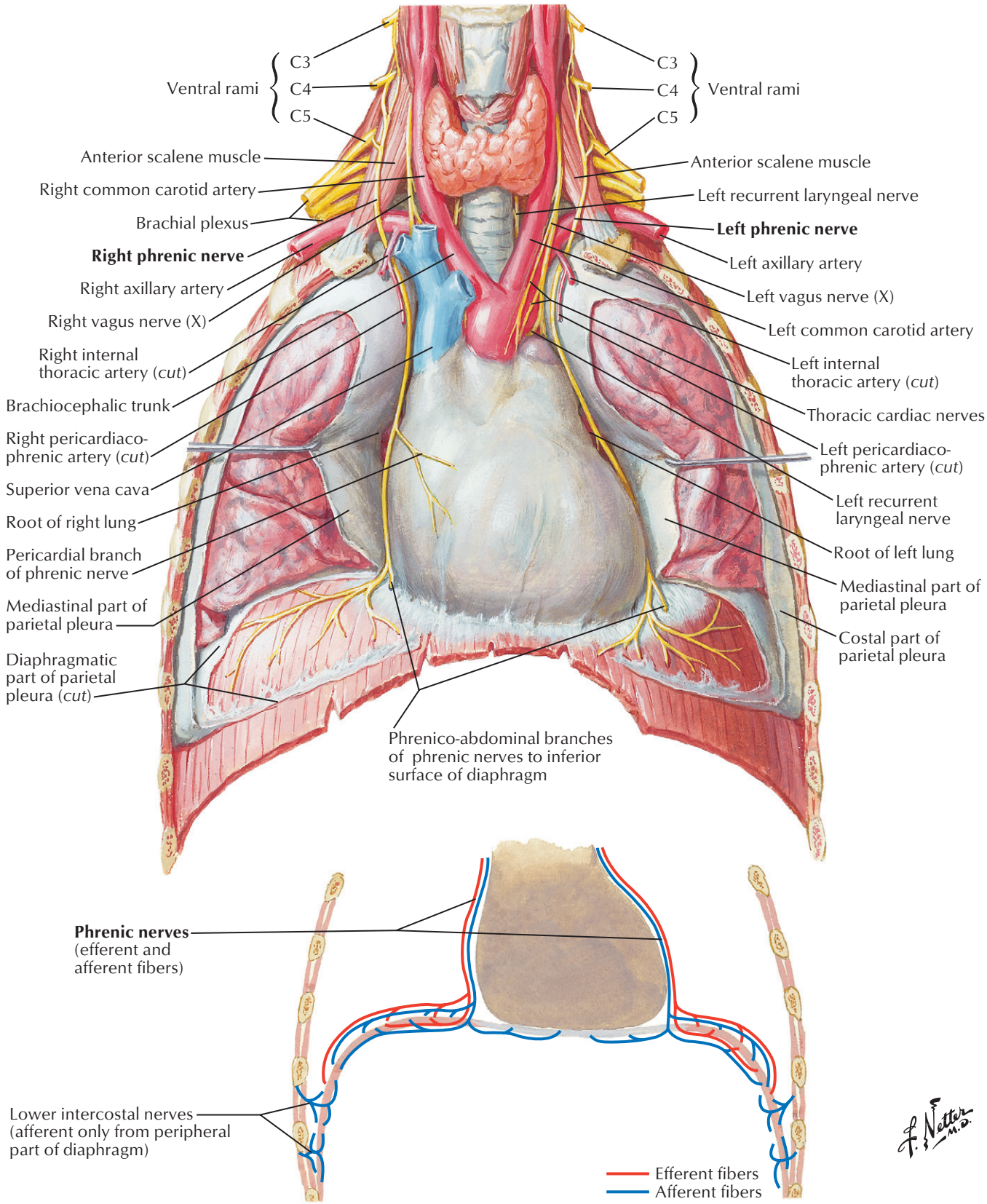

Ventral root
Dorsal root (spinal) ganglion
Spinal (radicular, or segmental medullary) branch of posterior intercostal artery
Dorsal branch of posterior intercostal artery
Trapezius muscle
Rhomboid major muscle
Erector spinae muscle
Posterior intercostal artery
Internal intercostal membrane
Scapula
Infraspinatus muscle
Subscapularis muscle
Teres minor muscle
Medial branch
Lateral branch
Dorsal ramus of thoracic nerve
Intercostal nerve (ventral ramus of thoracic spinal nerve)
Internal intercostal membrane deep to external intercostal muscle
Serratus anterior muscle
Gray and white rami communicantes
Sympathetic trunk and ganglion
Thoracic aorta
Right posterior intercostal arteries (cut)
Innermost intercostal muscle
Internal intercostal muscle
External intercostal muscle
Transversus thoracis muscle
Sternum
Internal thoracic artery
Lateral cutaneous branch of intercostal nerve
Anterior branch of lateral cutaneous branch of intercostal nerve
External oblique muscle
Pectoralis major muscle
Anterior cutaneous branch of intercostal nerve
Perforating branch
Superior epigastric artery
Rectus abdominis muscle
Anterior intercostal arteries
External intercostal membrane
Lateral cutaneous branch of posterior intercostal artery
External oblique muscle
F. Netter M.D.

Veins of Internal Thoracic Wall

See also Plates 187, 227, 252

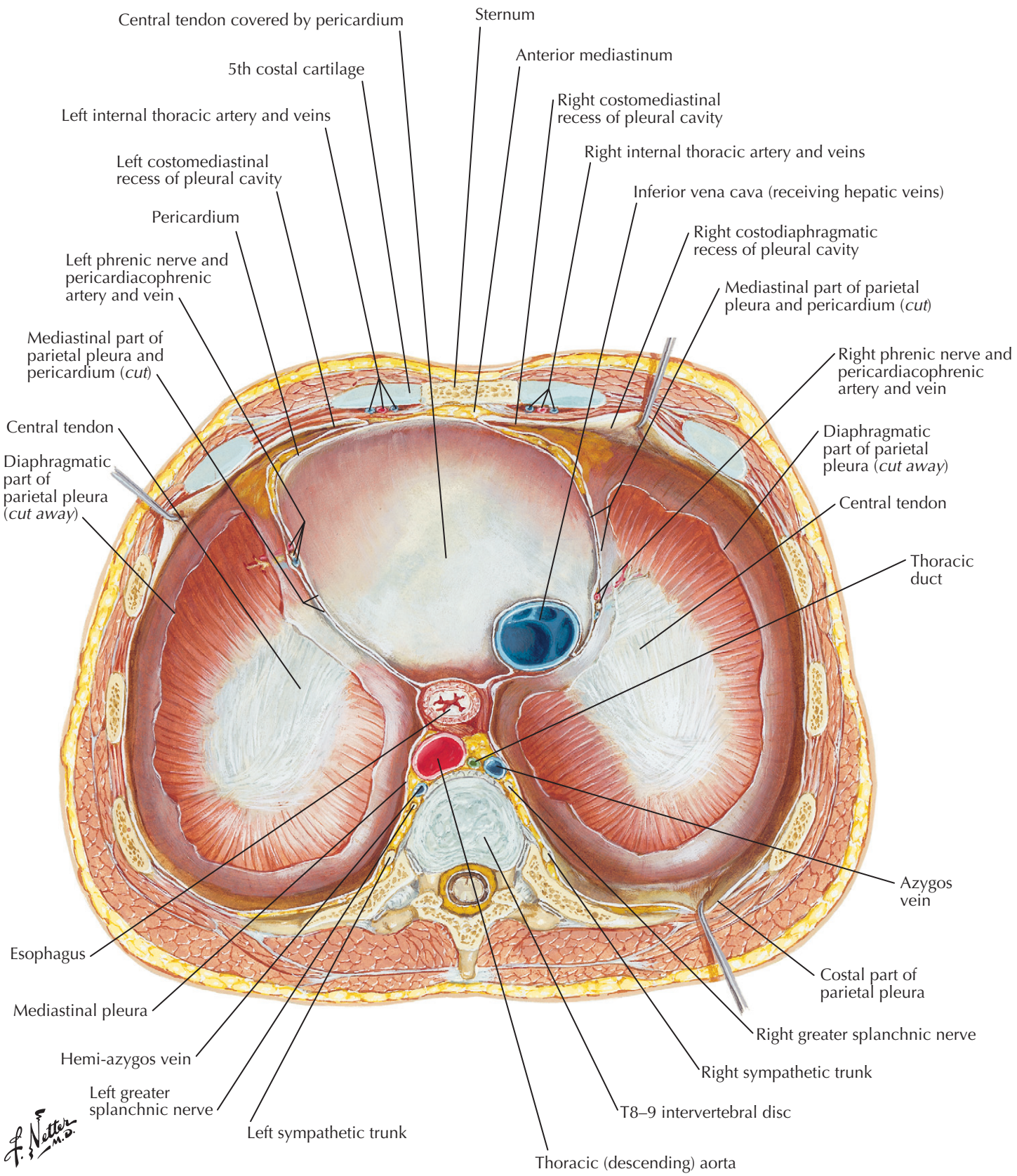


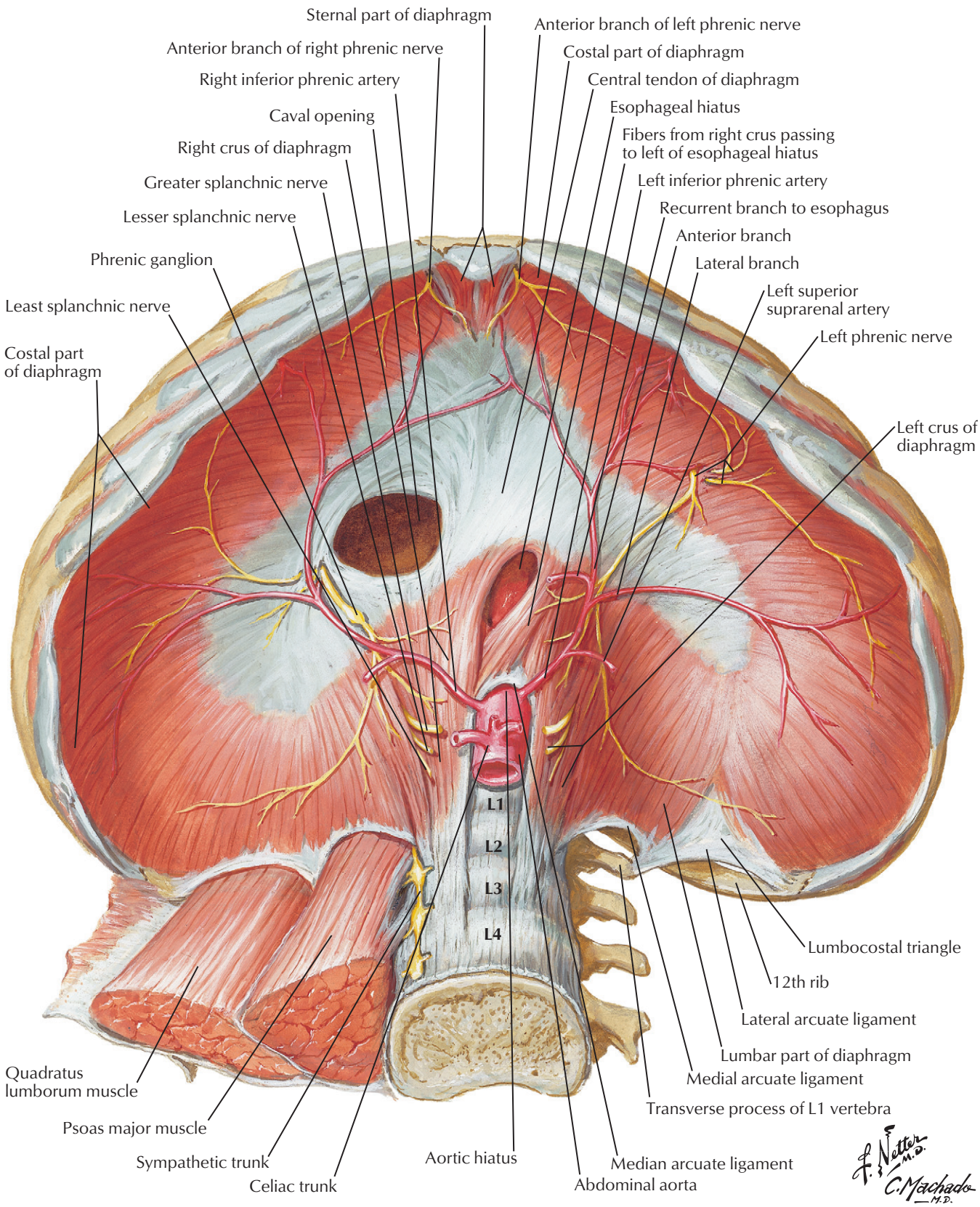
Inferior to the diaphragm, the azygos and hemi-azygos veins have connections with the ascending lumbar and/or the subcostal veins. The azygos vein may also arise from the inferior vena cava and the hemi-azygos vein from the left renal vein.


Ventral rami
C3
C4
C5
C3
C4
C5
Ventral rami
Anterior scalene muscle
Right common carotid artery
Brachial plexus
Right phrenic nerve
Right axillary artery
Right vagus nerve (X)
Right internal thoracic artery (cut)
Brachiocephalic trunk
Right pericardiaco-phrenic artery (cut)
Superior vena cava
Root of right lung
Pericardial branch of phrenic nerve
Mediastinal part of parietal pleura
Diaphragmatic part of parietal pleura (cut)
Anterior scalene muscle
Left recurrent laryngeal nerve
Left phrenic nerve
Left axillary artery
Left vagus nerve (X)
Left common carotid artery
Left internal thoracic artery (cut)
Thoracic cardiac nerves
Left pericardiaco-phrenic artery (cut)
Left recurrent laryngeal nerve
Root of left lung
Mediastinal part of parietal pleura
Costal part of parietal pleura
Phrenico-abdominal branches of phrenic nerves to inferior surface of diaphragm
Phrenic nerves (efferent and afferent fibers)
Lower intercostal nerves (afferent only from peripheral part of diaphragm)
Efferent fibers
Afferent fibers

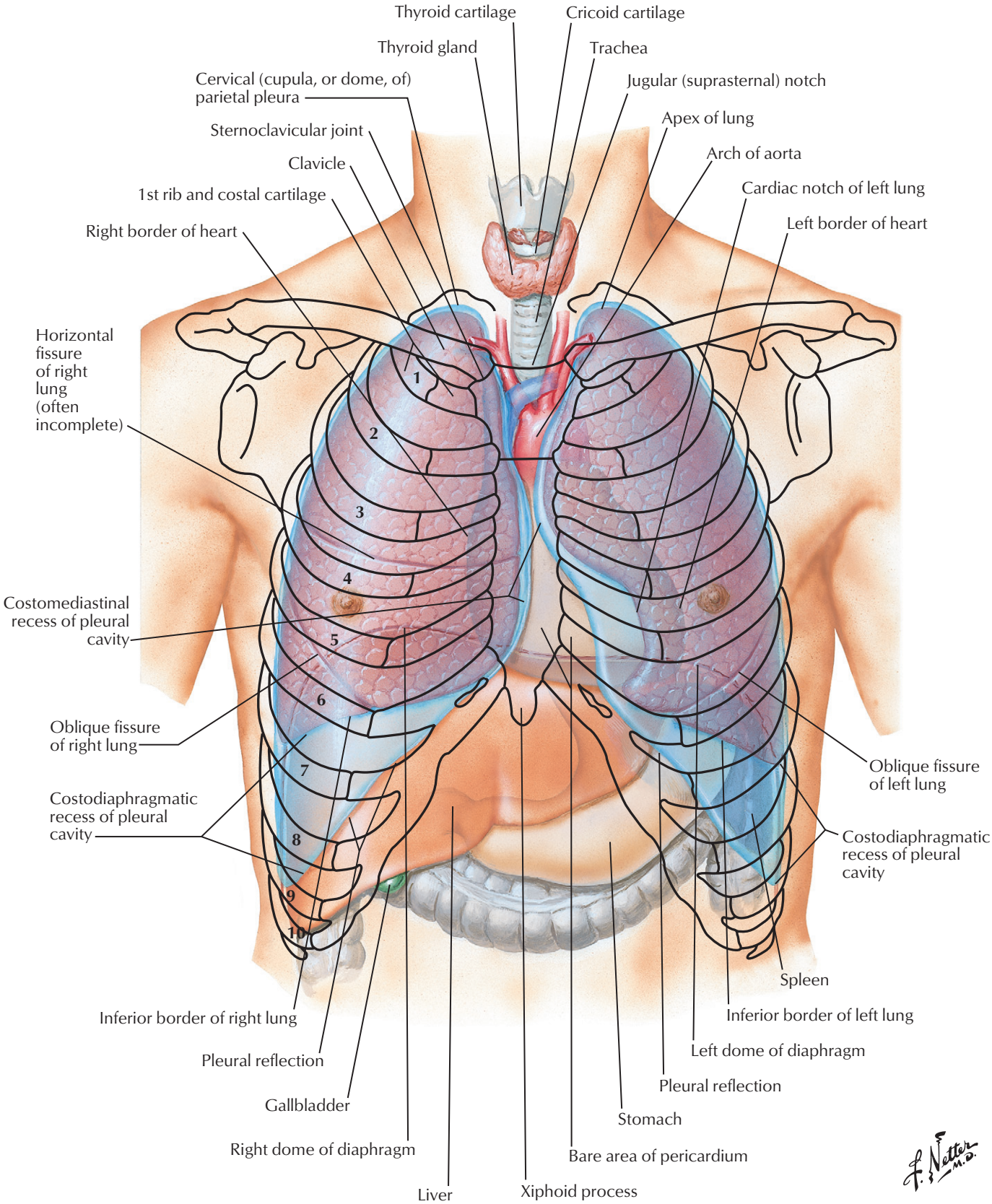
Diaphragm: Thoracic Surface

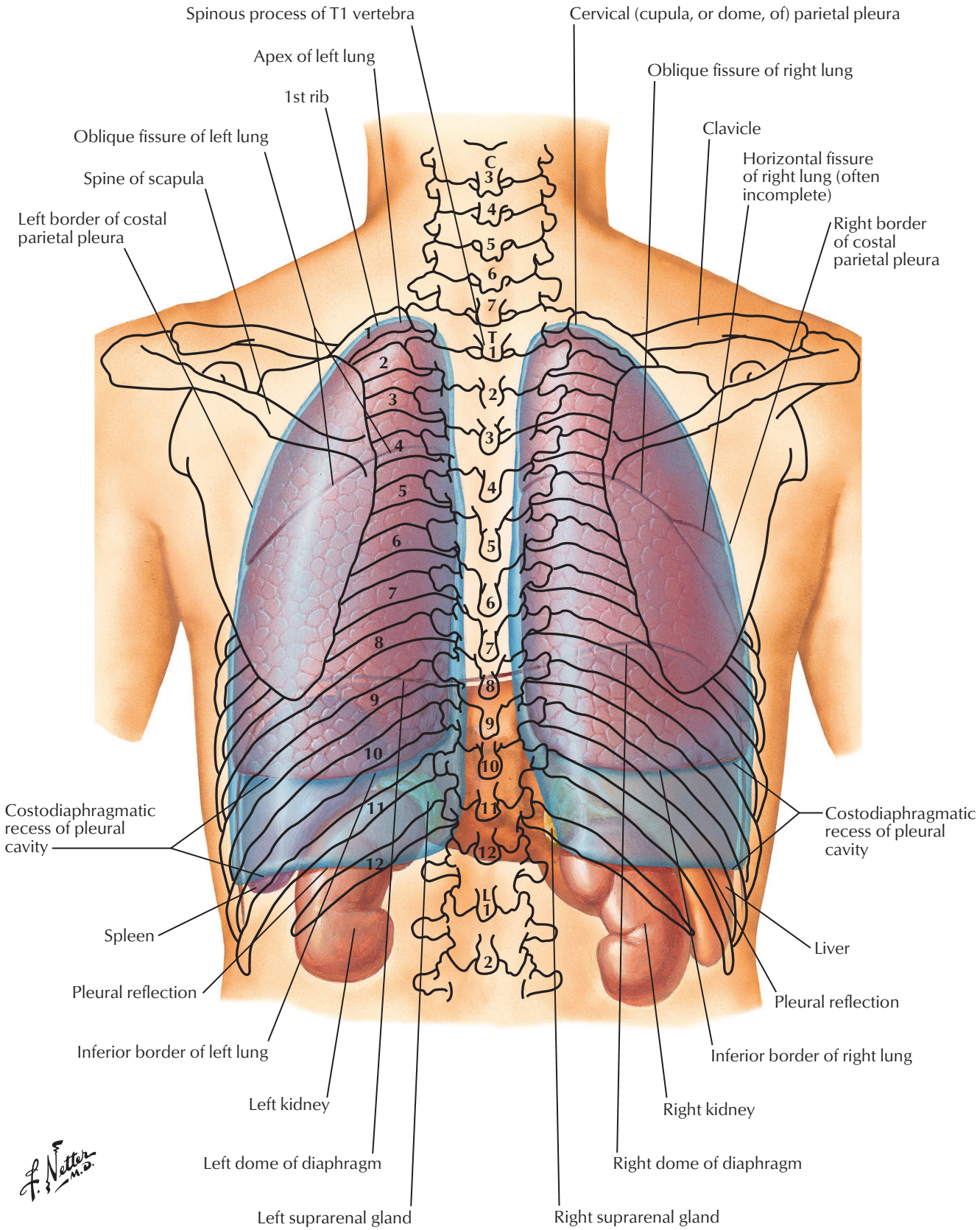
See also Plate 229

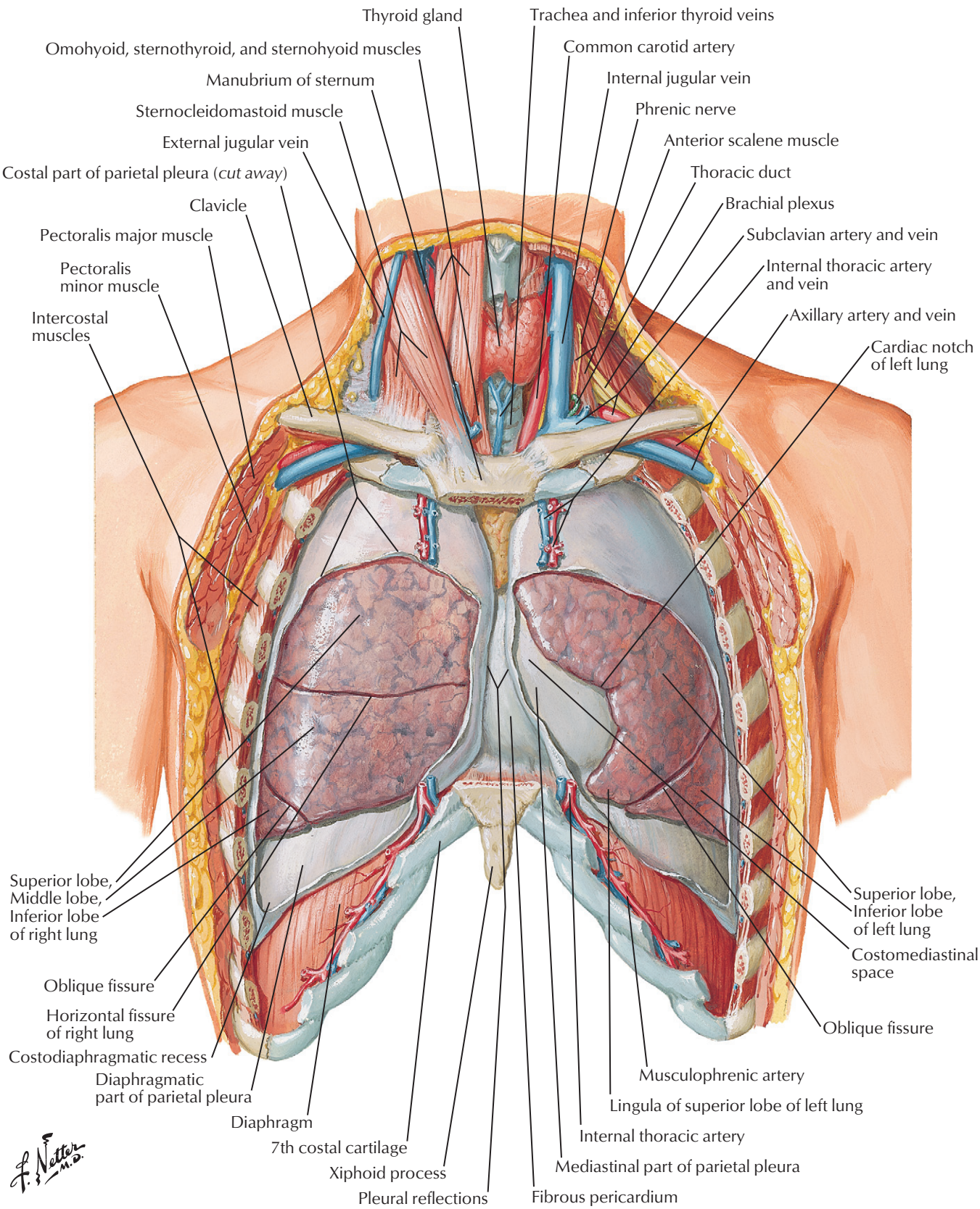


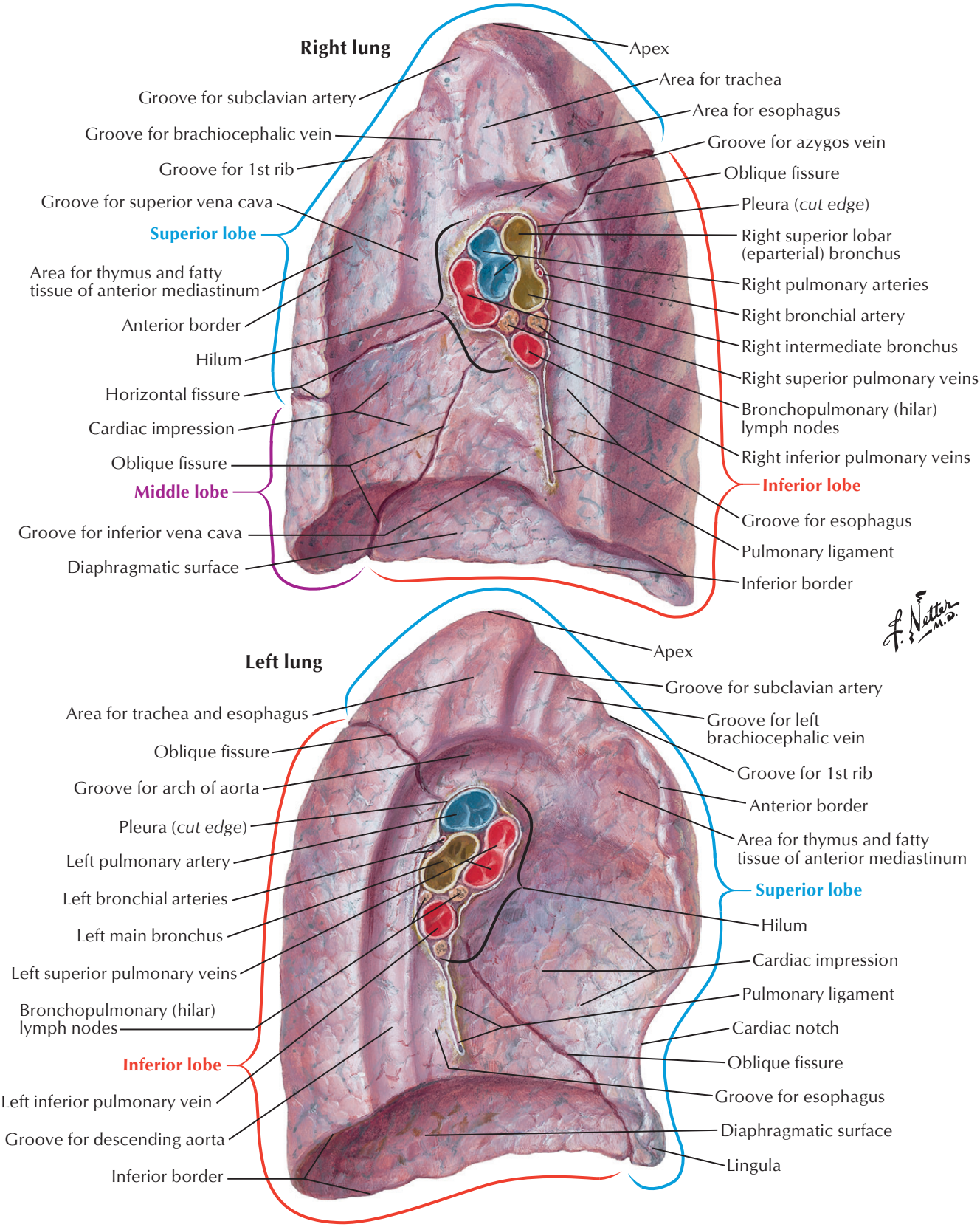

Sternal part of diaphragm
Anterior branch of right phrenic nerve
Right inferior phrenic artery
Caval opening
Right crus of diaphragm
Greater splanchnic nerve
Lesser splanchnic nerve
Phrenic ganglion
Least splanchnic nerve
Costal part of diaphragm
Anterior branch of left phrenic nerve
Costal part of diaphragm
Central tendon of diaphragm
Esophageal hiatus
Fibers from right crus passing to left of esophageal hiatus
Left inferior phrenic artery
Recurrent branch to esophagus
Anterior branch
Lateral branch
Left superior suprarenal artery
Left phrenic nerve
Left crus of diaphragm
L1
L2
L3
L4
Lumbocostal triangle
12th rib
Lateral arcuate ligament
Lumbar part of diaphragm
Medial arcuate ligament
Transverse process of L1 vertebra
Quadratus lumborum muscle
Psoas major muscle
Sympathetic trunk
Celiac trunk
Aortic hiatus
Median arcuate ligament
Abdominal aorta

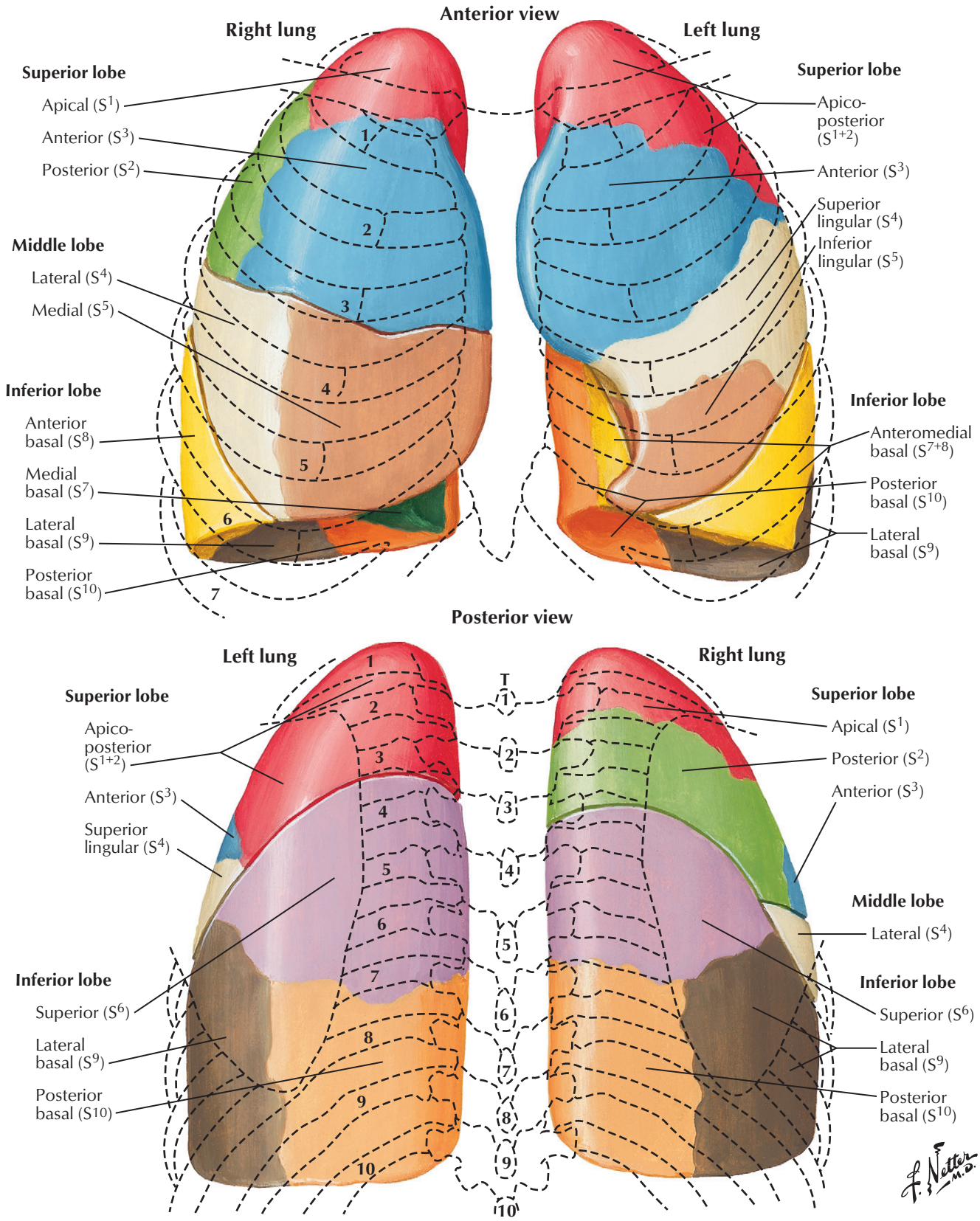
Topography of Lungs: Anterior View



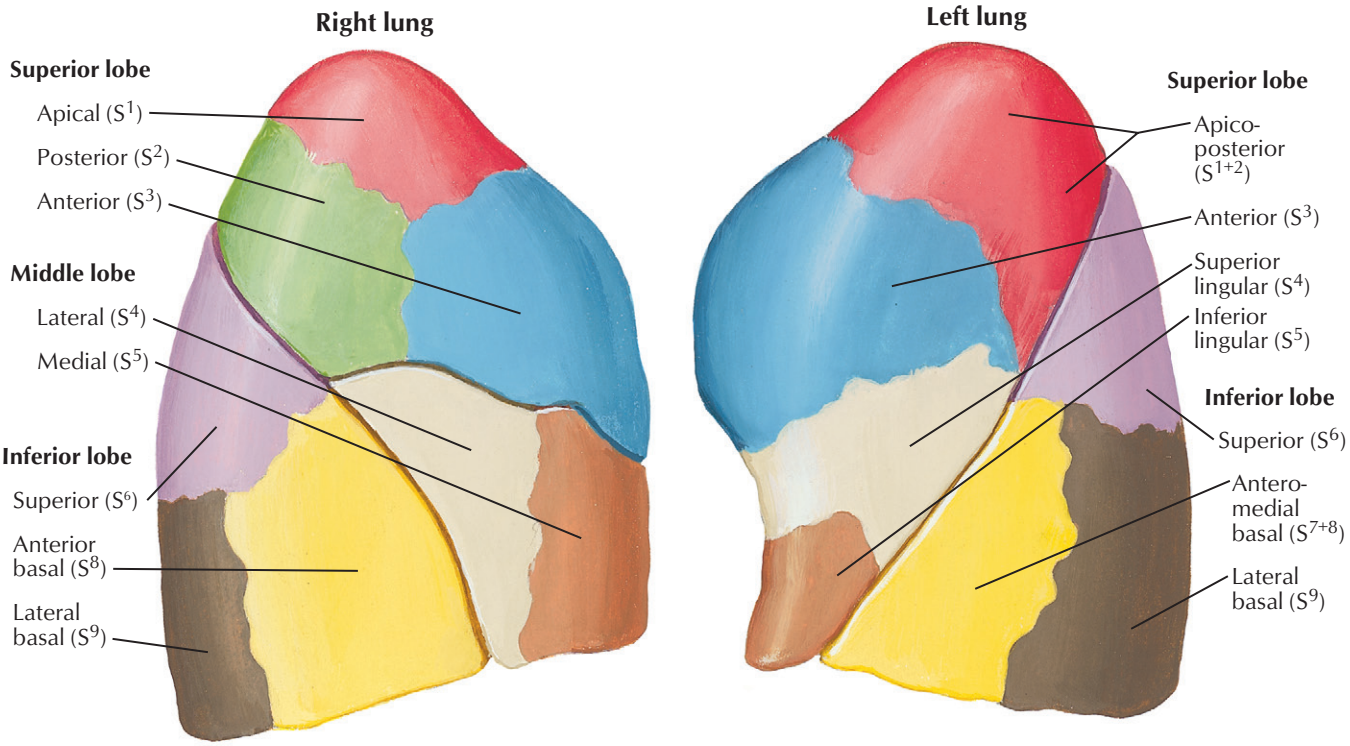

Spinous process of T1 vertebra
Cervical (cupula, or dome, of) parietal pleura
Apex of left lung
Oblique fissure of right lung
1st rib
Clavicle
Oblique fissure of left lung
Horizontal fissure of right lung (often incomplete)
Spine of scapula
Left border of costal parietal pleura
Right border of costal parietal pleura
C 3
4
5
6
7
T 1
1
2
3
4
5
6
7
8
9
10
11
12
L 1
2
3
4
5
6
7
8
9
10
11
12
Costodiaphragmatic recess of pleural cavity
Costodiaphragmatic recess of pleural cavity
Spleen
Liver
Pleural reflection
Pleural reflection
Inferior border of left lung
Inferior border of right lung
Left kidney
Right kidney
Left dome of diaphragm
Right dome of diaphragm
Left suprarenal gland
Right suprarenal gland


Thyroid gland
Trachea and inferior thyroid veins
Omohyoid, sternothyroid, and sternohyoid muscles
Common carotid artery
Manubrium of sternum
Internal jugular vein
Sternocleidomastoid muscle
Phrenic nerve
External jugular vein
Anterior scalene muscle
Costal part of parietal pleura (cut away)
Thoracic duct
Clavicle
Brachial plexus
Pectoralis major muscle
Subclavian artery and vein
Pectoralis minor muscle
Internal thoracic artery and vein
Intercostal muscles
Axillary artery and vein
Cardiac notch of left lung
Superior lobe, Middle lobe, Inferior lobe of right lung
Superior lobe, Inferior lobe of left lung
Costomediastinal space
Oblique fissure
Horizontal fissure of right lung
Oblique fissure
Costodiaphragmatic recess
Musculophrenic artery
Diaphragmatic part of parietal pleura
Lingula of superior lobe of left lung
Diaphragm
Internal thoracic artery
7th costal cartilage
Mediastinal part of parietal pleura
Xiphoid process
Pleural reflections
Fibrous pericardium

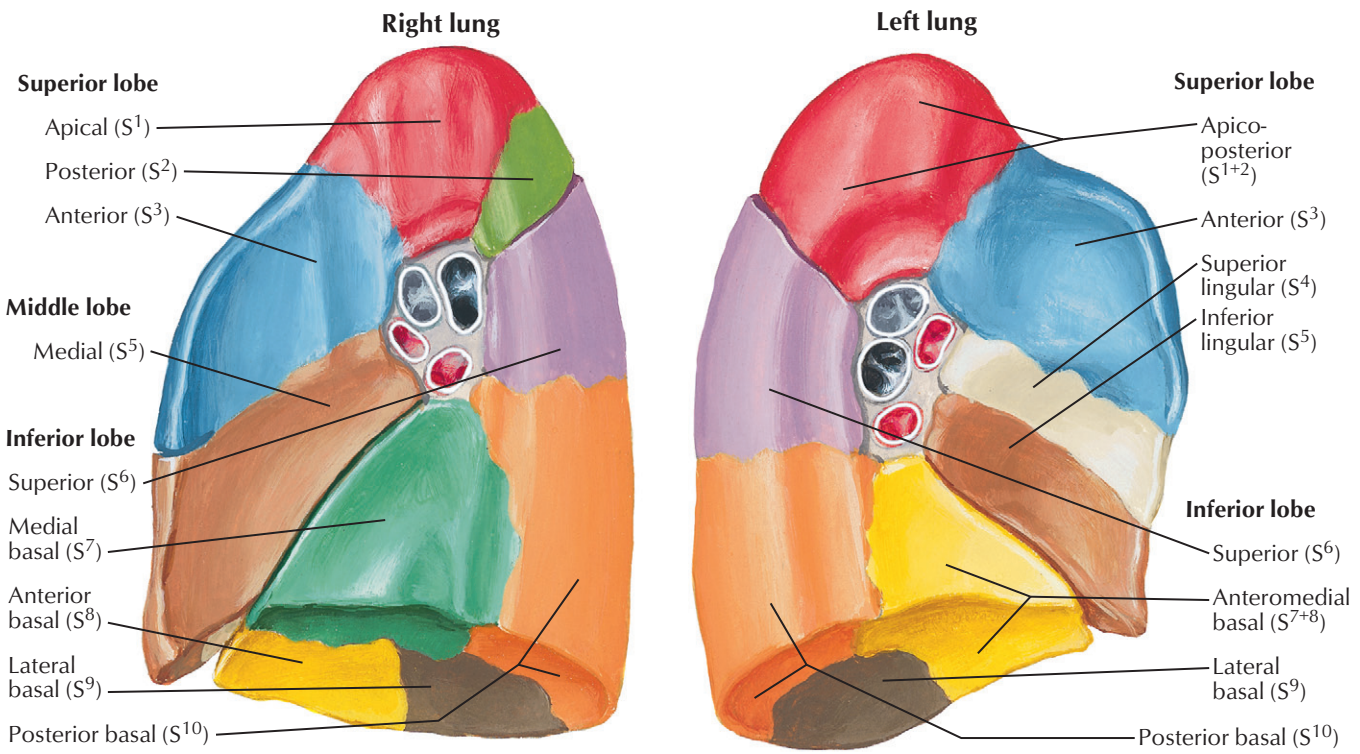

Right lung
Apex
Area for trachea
Area for esophagus
Groove for azygos vein
Oblique fissure
Pleura (cut edge)
Right superior lobar (eparterial) bronchus
Right pulmonary arteries
Right bronchial artery
Right intermediate bronchus
Right superior pulmonary veins
Bronchopulmonary (hilar) lymph nodes
Right inferior pulmonary veins
Inferior lobe
Groove for esophagus
Pulmonary ligament
Inferior border
Groove for subclavian artery
Groove for brachiocephalic vein
Groove for 1st rib
Groove for superior vena cava
Superior lobe
Area for thymus and fatty tissue of anterior mediastinum
Anterior border
Hilum
Horizontal fissure
Cardiac impression
Oblique fissure
Middle lobe
Groove for inferior vena cava
Diaphragmatic surface
F. Netter M.D.
Left lung
Apex
Groove for subclavian artery
Groove for left brachiocephalic vein
Groove for 1st rib
Anterior border
Area for thymus and fatty tissue of anterior mediastinum
Superior lobe
Hilum
Cardiac impression
Pulmonary ligament
Cardiac notch
Oblique fissure
Groove for esophagus
Diaphragmatic surface
Lingula
Area for trachea and esophagus
Oblique fissure
Groove for arch of aorta
Pleura (cut edge)
Left pulmonary artery
Left bronchial arteries
Left main bronchus
Left superior pulmonary veins
Bronchopulmonary (hilar) lymph nodes
Inferior lobe
Left inferior pulmonary vein
Groove for descending aorta
Inferior border


Anterior view
Right lung
Left lung
Superior lobe
Apical (S1)
Anterior (S3)
Posterior (S2)
Middle lobe
Lateral (S4)
Medial (S5)
Inferior lobe
Anterior basal (S8)
Medial basal (S7)
Lateral basal (S9)
Posterior basal (S10)
Superior lobe
Apico-posterior (S1+2)
Anterior (S3)
Superior lingular (S4)
Inferior lingular (S5)
Inferior lobe
Anteromedial basal (S7+8)
Posterior basal (S10)
Lateral basal (S9)
Posterior view
Left lung
Right lung
Superior lobe
Apico-posterior (S1+2)
Anterior (S3)
Superior lingular (S4)
Inferior lobe
Superior (S6)
Lateral basal (S9)
Posterior basal (S10)
Superior lobe
Apical (S1)
Posterior (S2)
Anterior (S3)
Middle lobe
Lateral (S4)
Inferior lobe
Superior (S6)
Lateral basal (S9)
Posterior basal (S10)

Lateral views

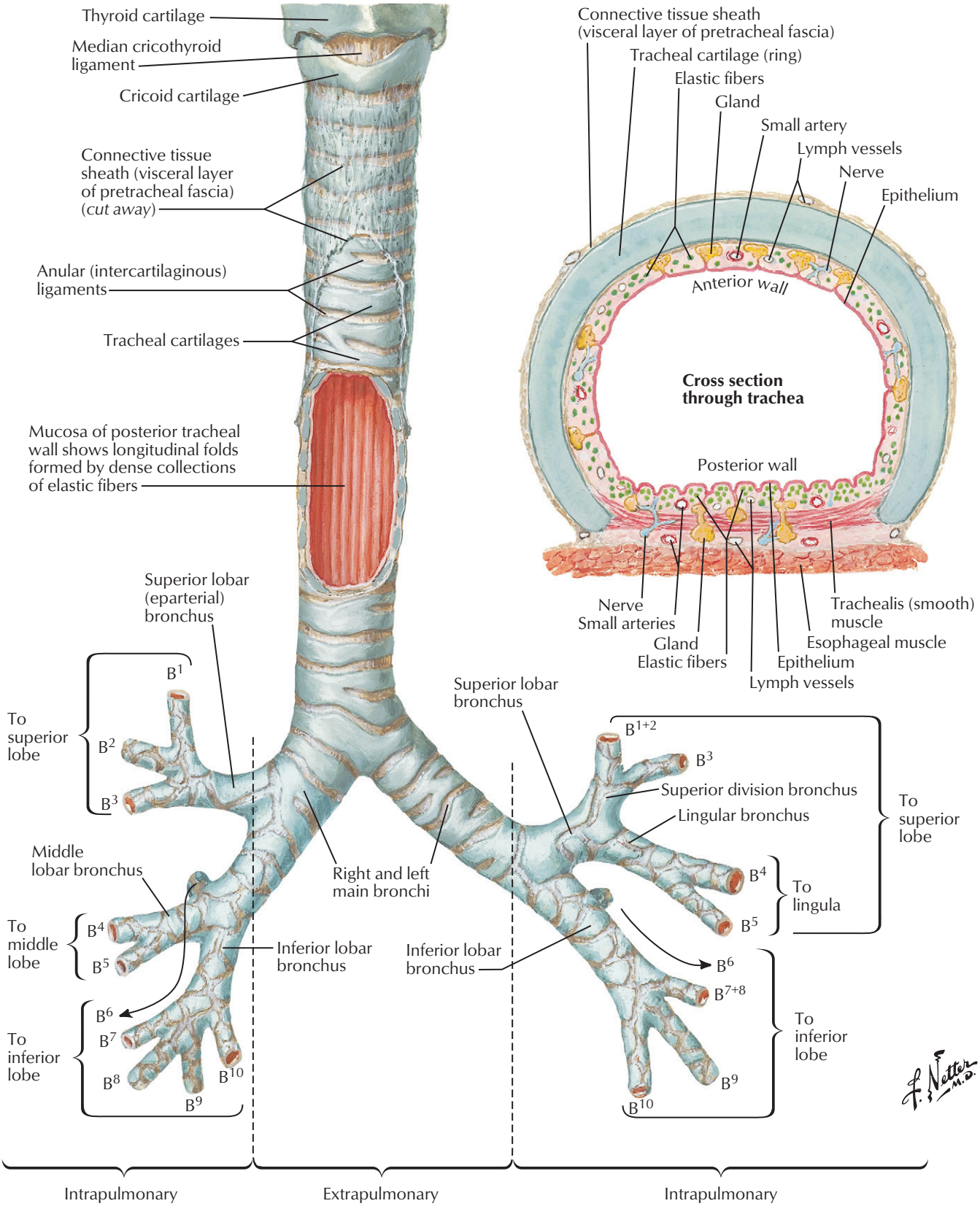


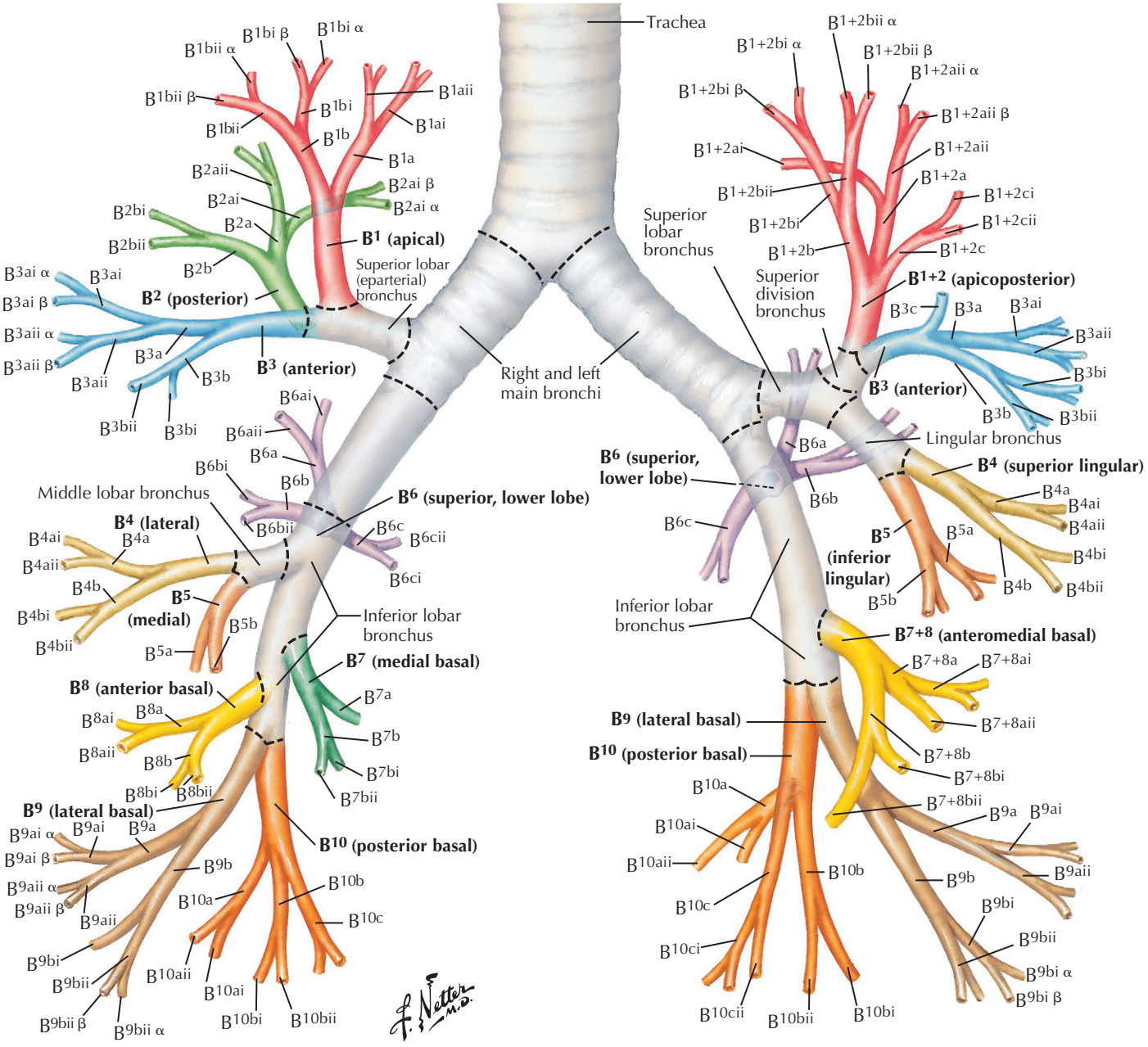
Medial views



Trachea and Major Bronchi

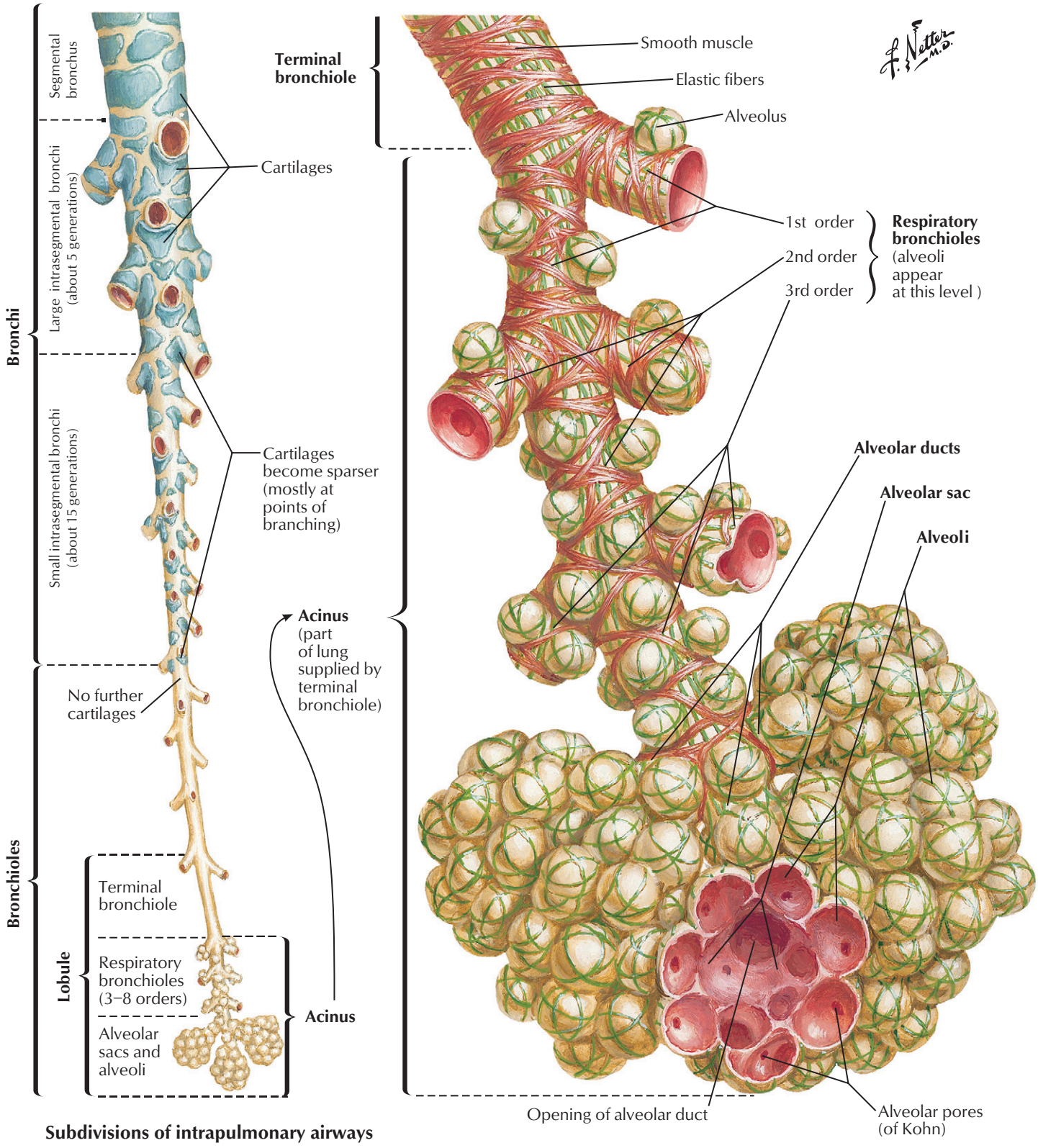
See also Plates 70, 204, 207





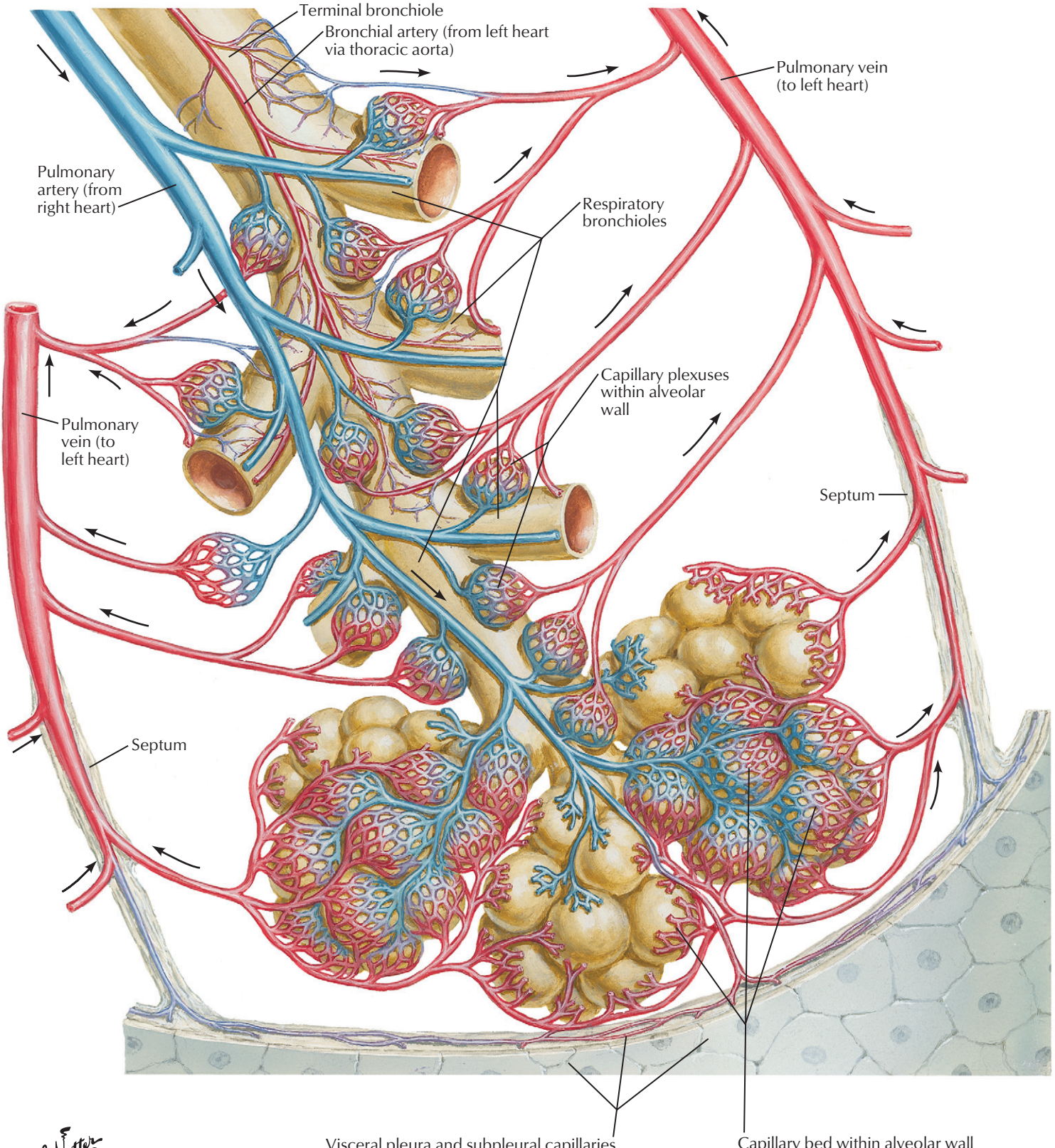
Nomenclature in common usage for bronchopulmonary segments (Plates 197 and 198) is that of Jackson and Huber, and segmental bronchi are named accordingly. Ikeda proposed nomenclature (as demonstrated here) for bronchial subdivisions as far as the 6th generation. For simplification on this illustration, only some bronchial subdivisions are labeled as far as the 5th or 6th generation. Segmental bronchi (B) are numbered from 1 to 10 in each lung, corresponding to pulmonary segments. In the left lung, B^1 and B^2 are combined as are B^7 and B^8. Subsegmental, or 4th order, bronchi are indicated by the addition of lowercase letters a, b, or c when an additional branch is present. Fifth order bronchi are designated by Roman numerals i (anterior) or ii (posterior) and 6th order bronchi by Greek letters α or β. Several texts use alternate numbers (as proposed by Boyden) for segmental bronchi.

Variations of the standard bronchial pattern shown here are common, especially in peripheral airways.

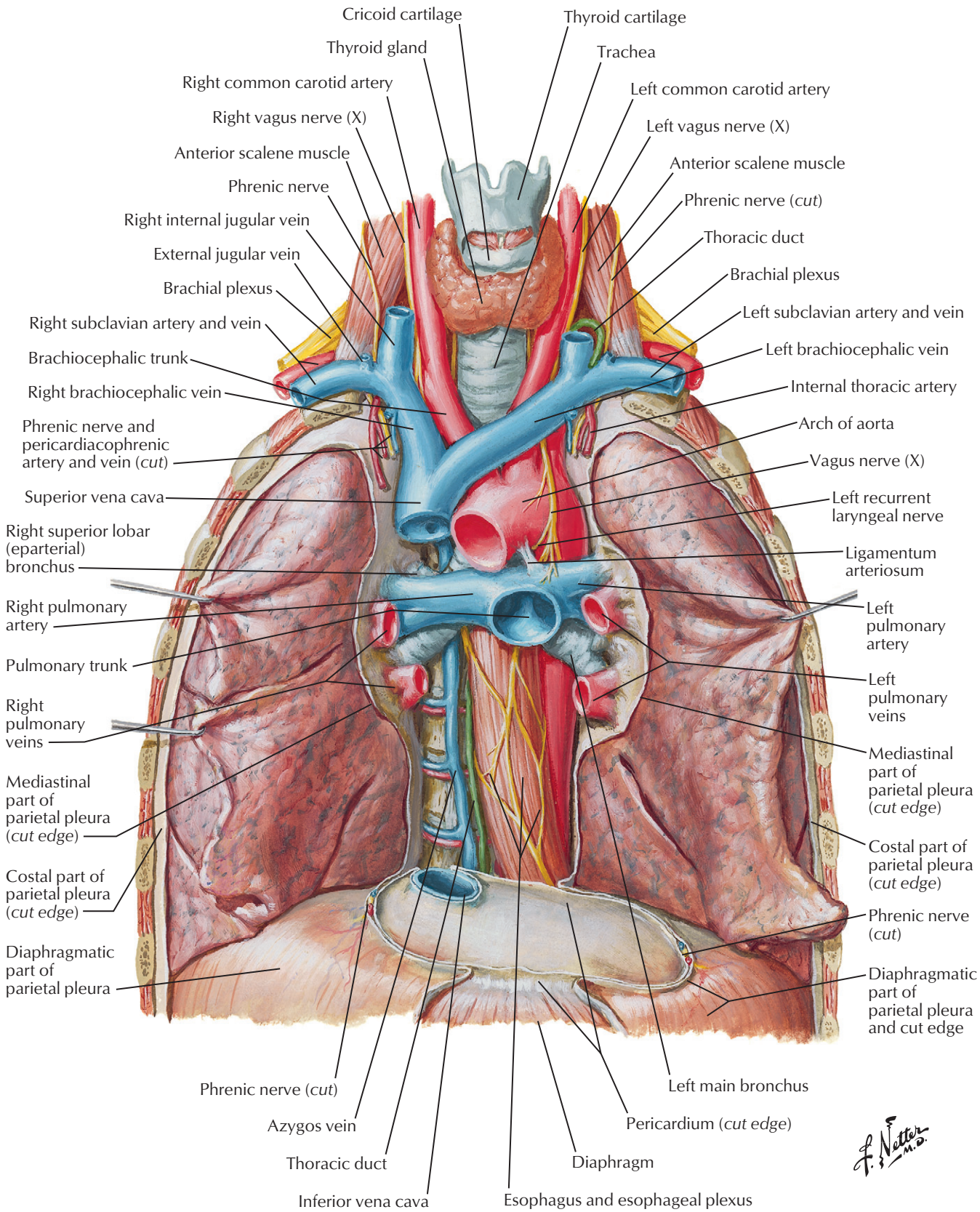


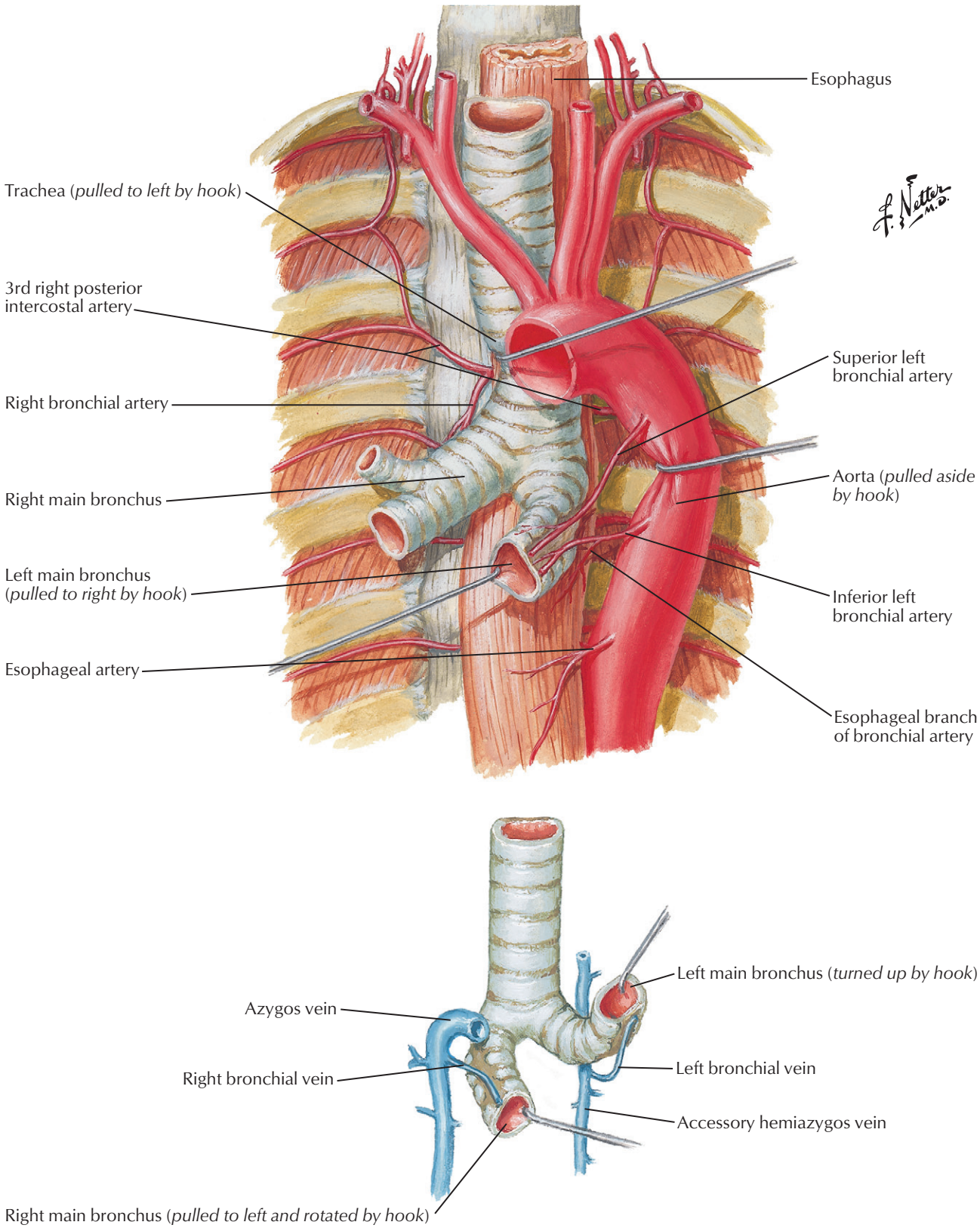
Subdivisions of intrapulmonary airways

Structure of intrapulmonary airways



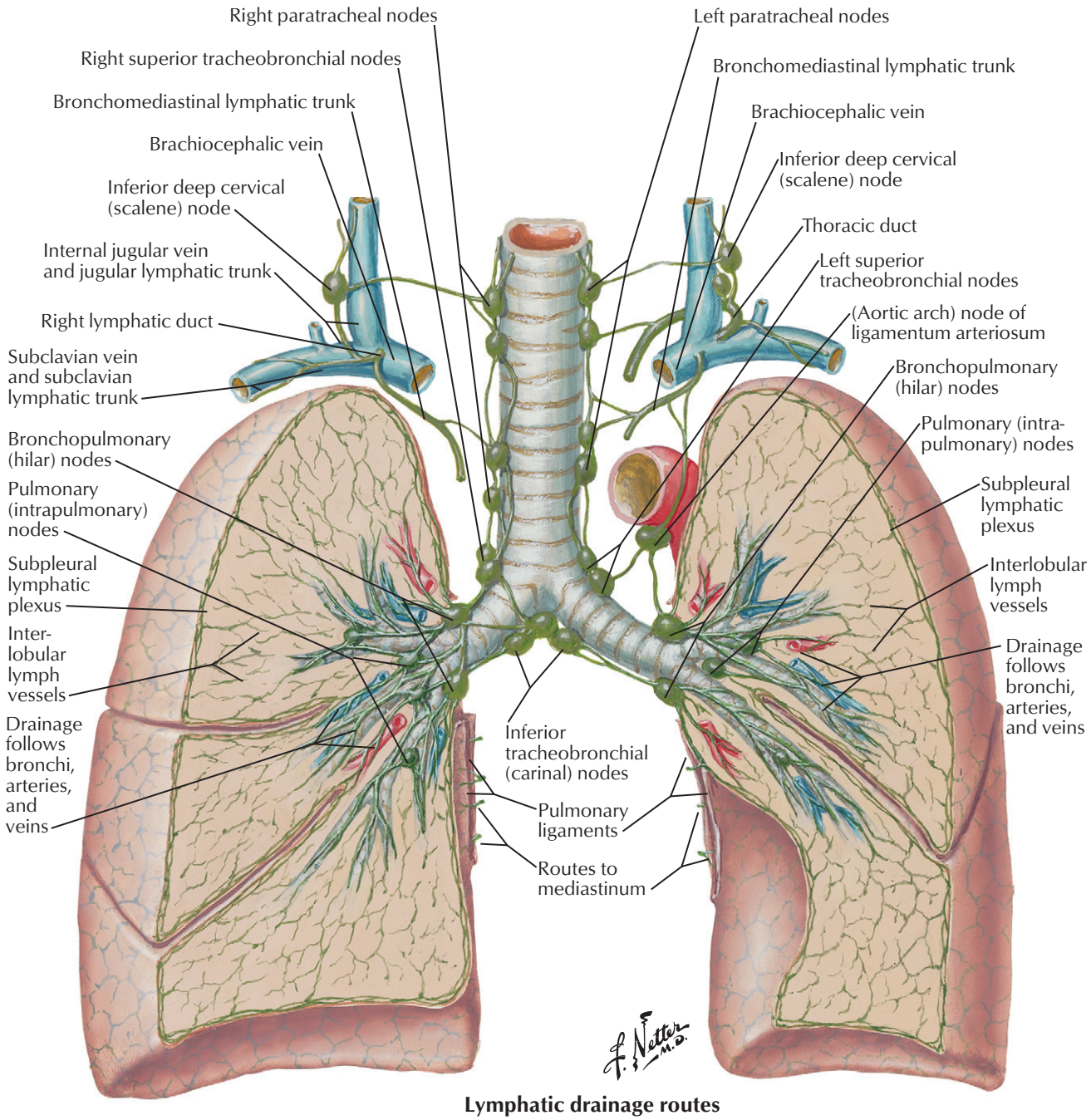
Pulmonary arteries and their branches distribute segmentally with the bronchi. Pulmonary veins and their tributaries drain intersegmentally.


Cricoid cartilage
Thyroid cartilage
Thyroid gland
Trachea
Right common carotid artery
Left common carotid artery
Right vagus nerve (X)
Left vagus nerve (X)
Anterior scalene muscle
Anterior scalene muscle
Phrenic nerve
Phrenic nerve (cut)
Right internal jugular vein
Thoracic duct
External jugular vein
Brachial plexus
Brachial plexus
Left subclavian artery and vein
Right subclavian artery and vein
Left brachiocephalic vein
Brachiocephalic trunk
Internal thoracic artery
Right brachiocephalic vein
Arch of aorta
Phrenic nerve and pericardiacophrenic artery and vein (cut)
Vagus nerve (X)
Superior vena cava
Left recurrent laryngeal nerve
Right superior lobar (eparterial) bronchus
Ligamentum arteriosum
Left pulmonary artery
Right pulmonary artery
Pulmonary trunk
Left pulmonary veins
Right pulmonary veins
Mediastinal part of parietal pleura (cut edge)
Mediastinal part of parietal pleura (cut edge)
Costal part of parietal pleura (cut edge)
Costal part of parietal pleura (cut edge)
Phrenic nerve (cut)
Diaphragmatic part of parietal pleura
Diaphragmatic part of parietal pleura and cut edge
Phrenic nerve (cut)
Left main bronchus
Azygos vein
Pericardium (cut edge)
Thoracic duct
Diaphragm
Inferior vena cava
Esophagus and esophageal plexus


Esophagus
Trachea (*pulled to left by hook*)
3rd right posterior intercostal artery
Right bronchial artery
Right main bronchus
Left main bronchus (*pulled to right by hook*)
Esophageal artery
Superior left bronchial artery
Aorta (*pulled aside by hook*)
Inferior left bronchial artery
Esophageal branch of bronchial artery
Left main bronchus (*turned up by hook*)
Azygos vein
Right bronchial vein
Left bronchial vein
Accessory hemiazygos vein
Right main bronchus (*pulled to left and rotated by hook*)

Lymph Vessels and Nodes of Lung

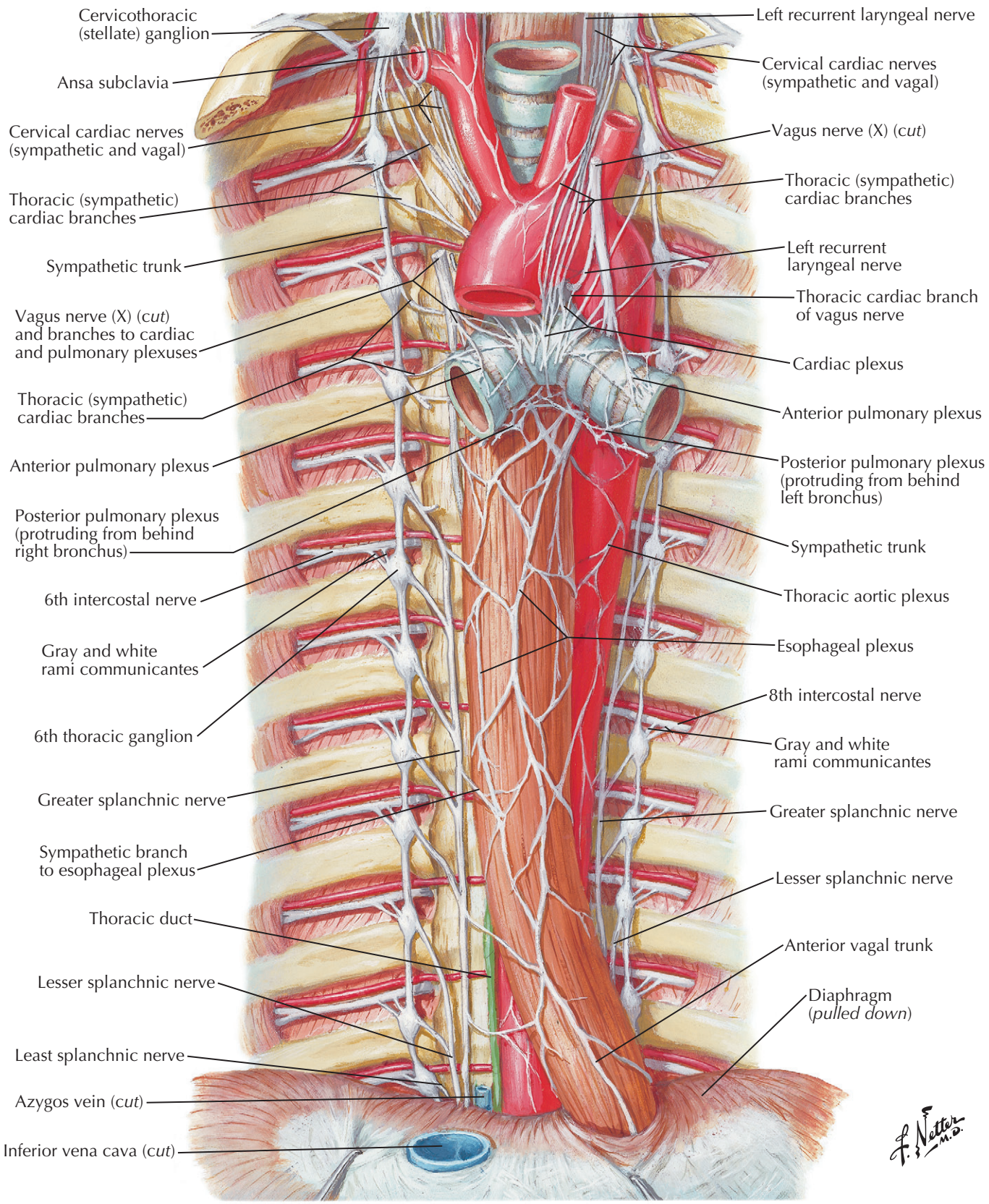
See also Plates 74, 235

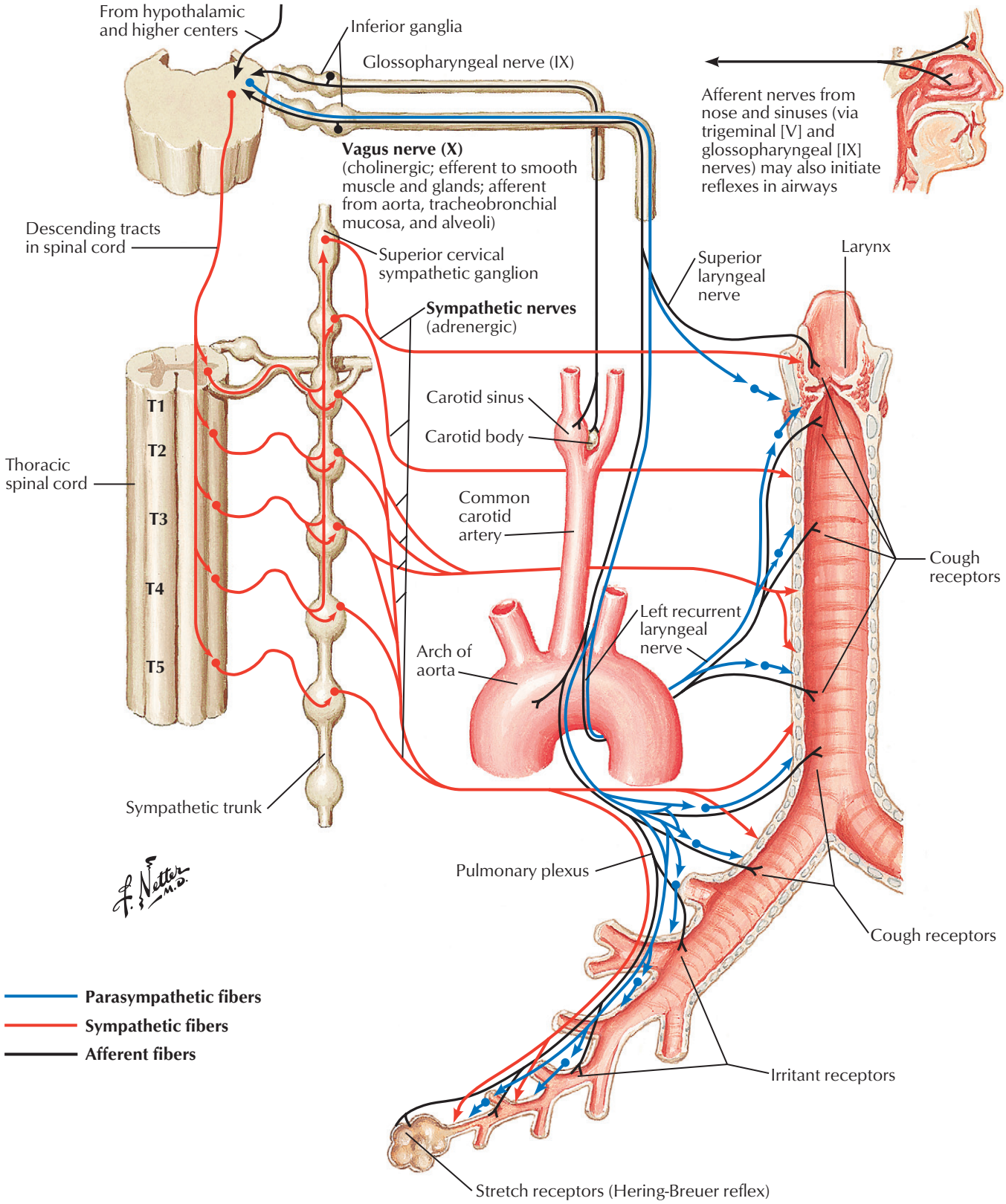


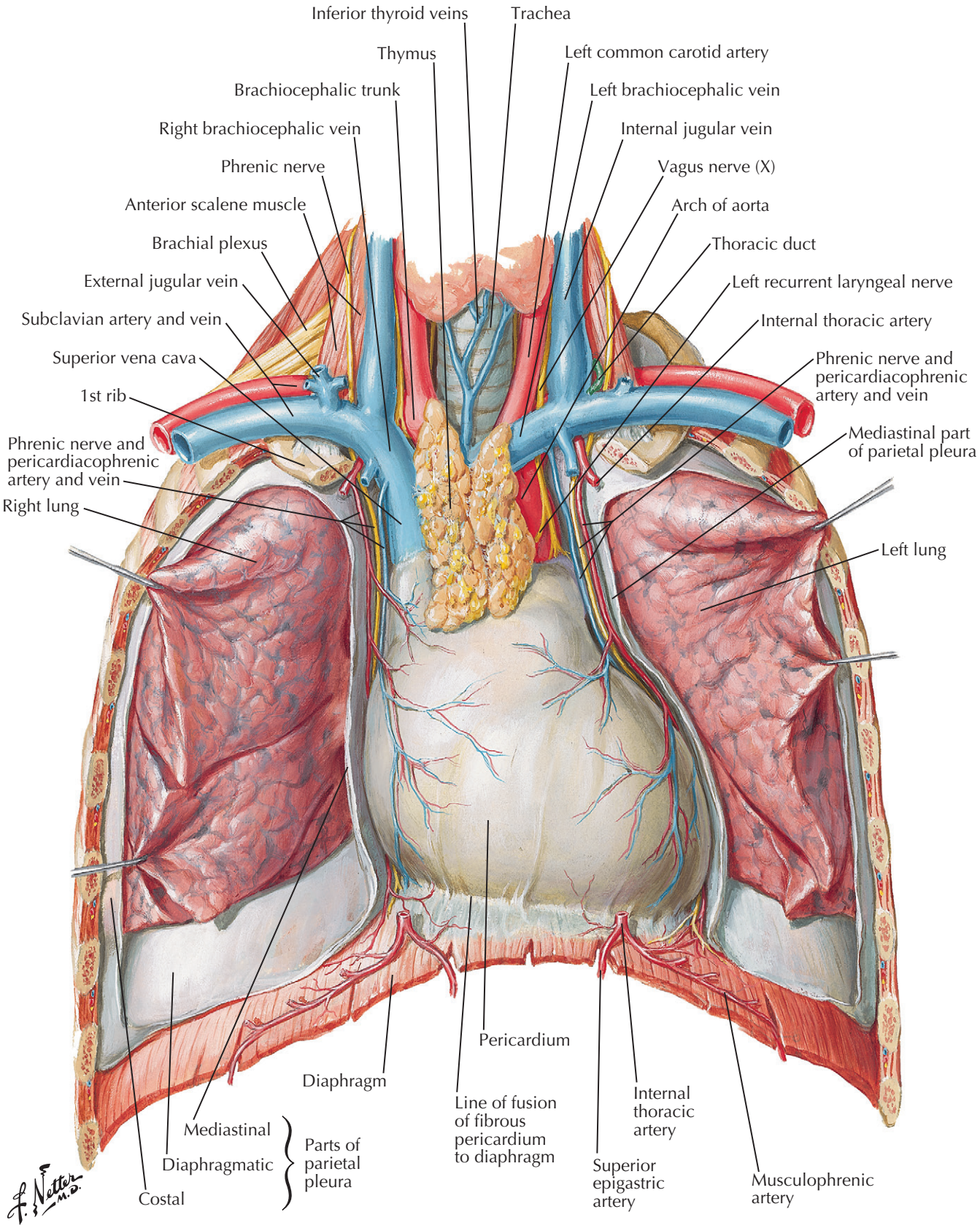
Lymphatic drainage routes

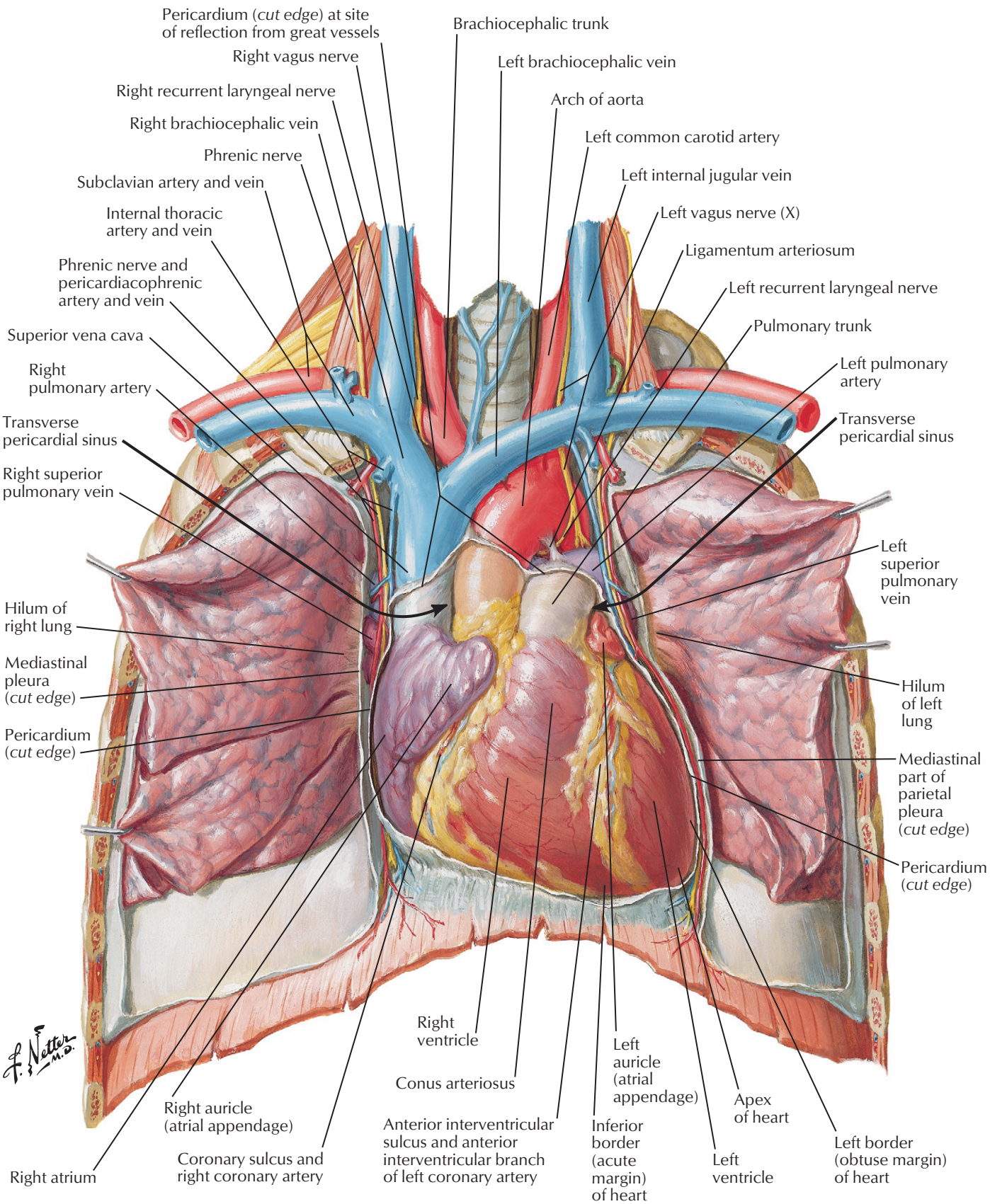
Right lung: All lobes drain to pulmonary and bronchopulmonary (hilar) nodes, then to inferior tracheobronchial (carinal) nodes, right superior tracheobronchial nodes, and right paratracheal nodes on the way to the brachiocephalic vein via the bronchomediastinal lymphatic trunk and/or inferior deep cervical (scalene) node.

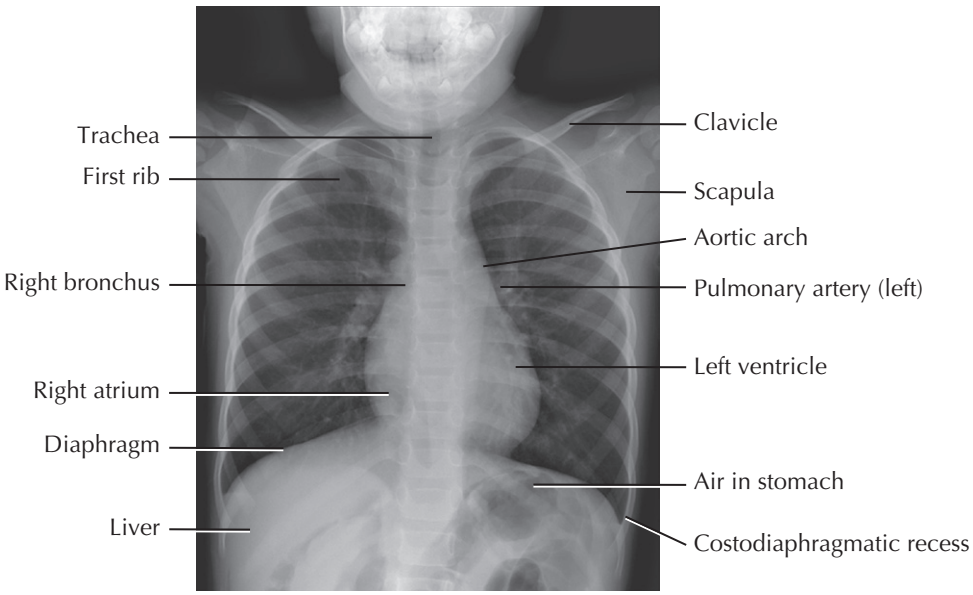
Left lung: The superior lobe drains to pulmonary and bronchopulmonary (hilar) nodes, inferior tracheobronchial (carinal) nodes, left superior tracheobronchial nodes, left paratracheal nodes and/or (aortic arch) node of ligamentum arteriosum, then to the brachiocephalic vein via the left bronchomediastinal trunk and thoracic duct. The left inferior lobe also drains to the pulmonary and bronchopulmonary (hilar) nodes and to inferior tracheobronchial (carinal) nodes, but then mostly to right superior tracheobronchial nodes, where it follows the same route as lymph from the right lung.

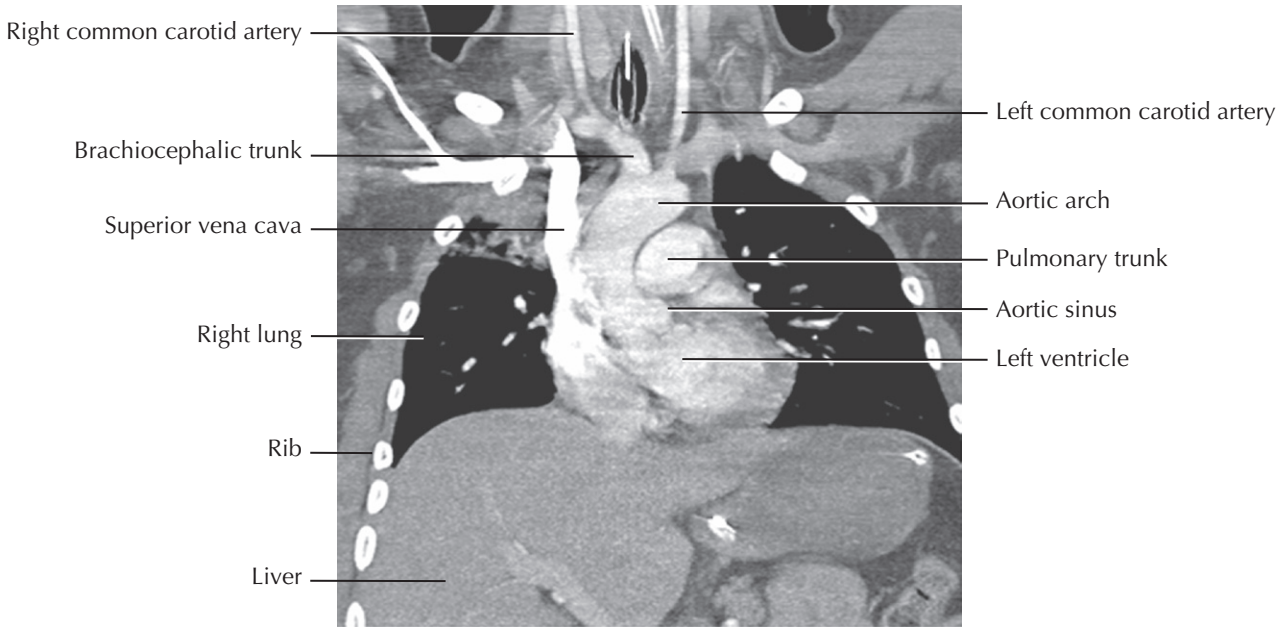

Cervicothoracic (stellate) ganglion
Ansa subclavia
Cervical cardiac nerves (sympathetic and vagal)
Thoracic (sympathetic) cardiac branches
Sympathetic trunk
Vagus nerve (X) (cut) and branches to cardiac and pulmonary plexuses
Thoracic (sympathetic) cardiac branches
Anterior pulmonary plexus
Posterior pulmonary plexus (protruding from behind right bronchus)
6th intercostal nerve
Gray and white rami communicantes
6th thoracic ganglion
Greater splanchnic nerve
Sympathetic branch to esophageal plexus
Thoracic duct
Lesser splanchnic nerve
Least splanchnic nerve
Azygos vein (cut)
Inferior vena cava (cut)
Left recurrent laryngeal nerve
Cervical cardiac nerves (sympathetic and vagal)
Vagus nerve (X) (cut)
Thoracic (sympathetic) cardiac branches
Left recurrent laryngeal nerve
Thoracic cardiac branch of vagus nerve
Cardiac plexus
Anterior pulmonary plexus
Posterior pulmonary plexus (protruding from behind left bronchus)
Sympathetic trunk
Thoracic aortic plexus
Esophageal plexus
8th intercostal nerve
Gray and white rami communicantes
Greater splanchnic nerve
Lesser splanchnic nerve
Anterior vagal trunk
Diaphragm (pulled down)


From hypothalamic and higher centers
Inferior ganglia
Glossopharyngeal nerve (IX)
Afferent nerves from nose and sinuses (via trigeminal [V] and glossopharyngeal [IX] nerves) may also initiate reflexes in airways
Vagus nerve (X)
(cholinergic; efferent to smooth muscle and glands; afferent from aorta, tracheobronchial mucosa, and alveoli)
Descending tracts in spinal cord
Superior cervical sympathetic ganglion
Superior laryngeal nerve
Larynx
Sympathetic nerves
(adrenergic)
T1
T2
T3
T4
T5
Thoracic spinal cord
Carotid sinus
Carotid body
Common carotid artery
Cough receptors
Left recurrent laryngeal nerve
Arch of aorta
Sympathetic trunk
Pulmonary plexus
Cough receptors
Parasympathetic fibers
Sympathetic fibers
Afferent fibers
Irritant receptors
Stretch receptors (Hering-Breuer reflex)

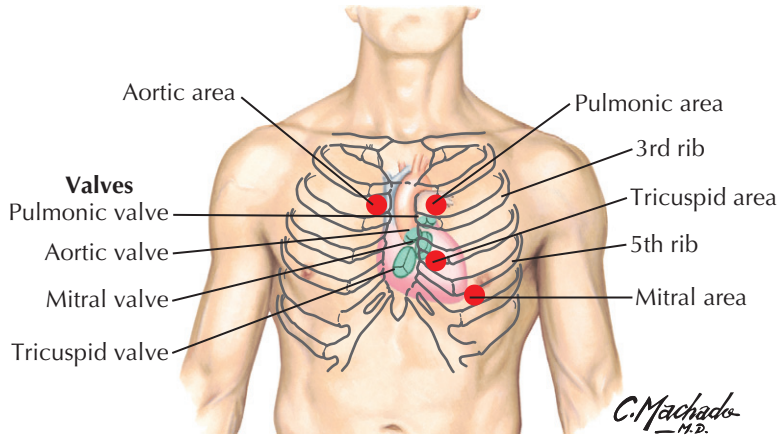

Inferior thyroid veins
Trachea
Thymus
Left common carotid artery
Brachiocephalic trunk
Left brachiocephalic vein
Right brachiocephalic vein
Internal jugular vein
Phrenic nerve
Vagus nerve (X)
Anterior scalene muscle
Arch of aorta
Brachial plexus
Thoracic duct
External jugular vein
Left recurrent laryngeal nerve
Subclavian artery and vein
Internal thoracic artery
Superior vena cava
Phrenic nerve and pericardiacophrenic artery and vein
1st rib
Mediastinal part of parietal pleura
Phrenic nerve and pericardiacophrenic artery and vein
Right lung
Left lung
Pericardium
Diaphragm
Line of fusion of fibrous pericardium to diaphragm
Internal thoracic artery
Mediastinal
Diaphragmatic
Parts of parietal pleura
Costal
Superior epigastric artery
Musculophrenic artery

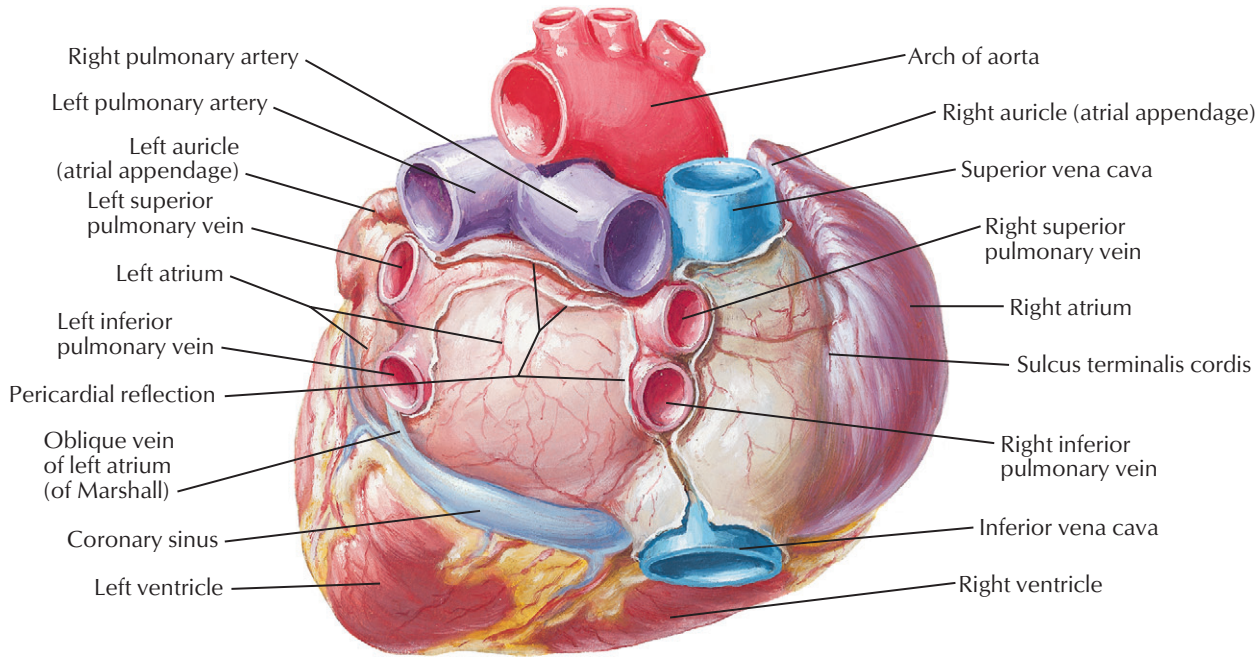

Pericardium (*cut edge*) at site of reflection from great vessels
Right vagus nerve
Right recurrent laryngeal nerve
Right brachiocephalic vein
Phrenic nerve
Subclavian artery and vein
Internal thoracic artery and vein
Phrenic nerve and pericardiacophrenic artery and vein
Superior vena cava
Right pulmonary artery
Transverse pericardial sinus
Right superior pulmonary vein
Hilum of right lung
Mediastinal pleura (*cut edge*)
Pericardium (*cut edge*)
Brachiocephalic trunk
Left brachiocephalic vein
Arch of aorta
Left common carotid artery
Left internal jugular vein
Left vagus nerve (X)
Ligamentum arteriosum
Left recurrent laryngeal nerve
Pulmonary trunk
Left pulmonary artery
Transverse pericardial sinus
Left superior pulmonary vein
Hilum of left lung
Mediastinal part of parietal pleura (*cut edge*)
Pericardium (*cut edge*)
Right ventricle
Conus arteriosus
Left auricle (atrial appendage)
Apex of heart
Right auricle (atrial appendage)
Anterior interventricular sulcus and anterior interventricular branch of left coronary artery
Inferior border (acute margin) of heart
Left ventricle
Left border (obtuse margin) of heart
Right atrium
Coronary sulcus and right coronary artery



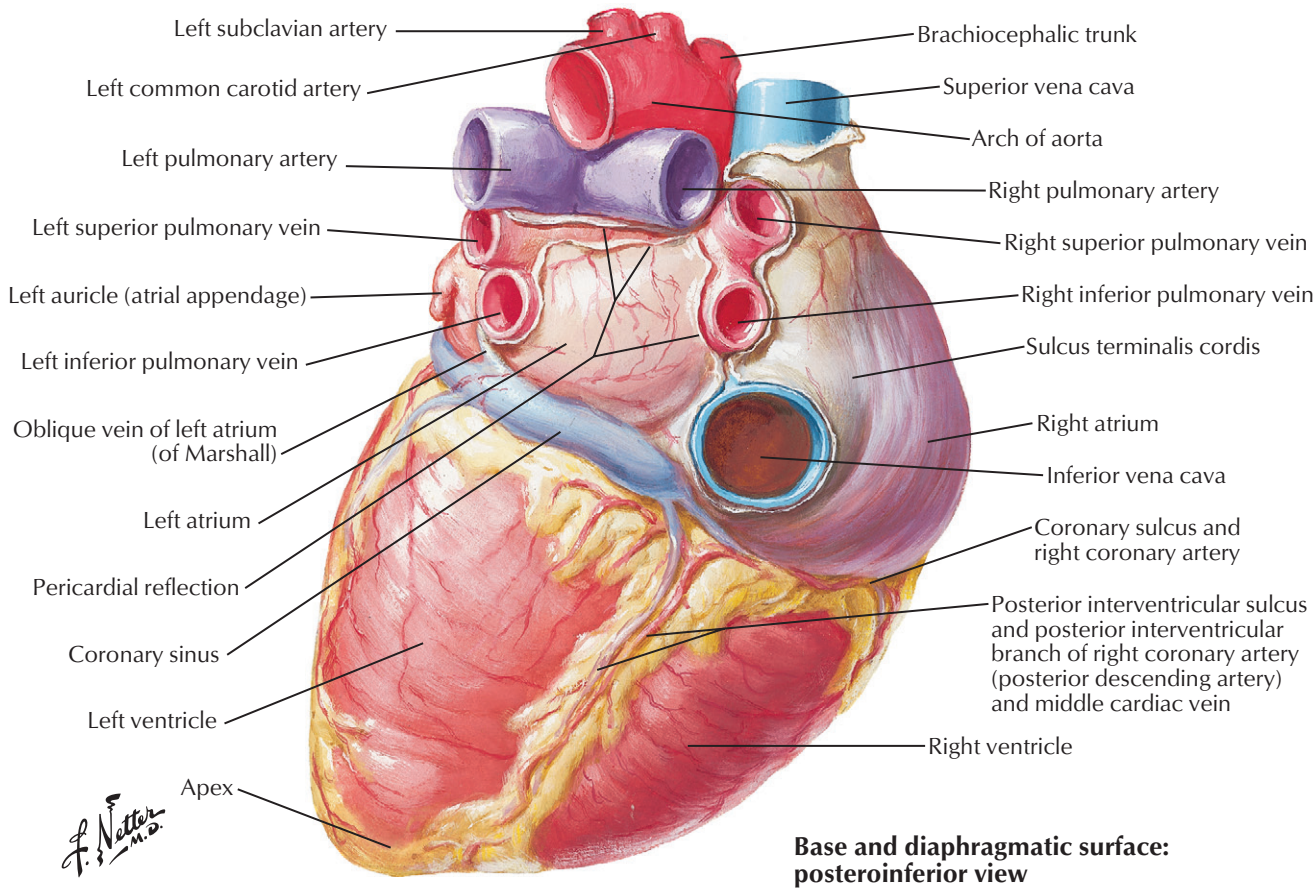


Precordial areas of auscultation

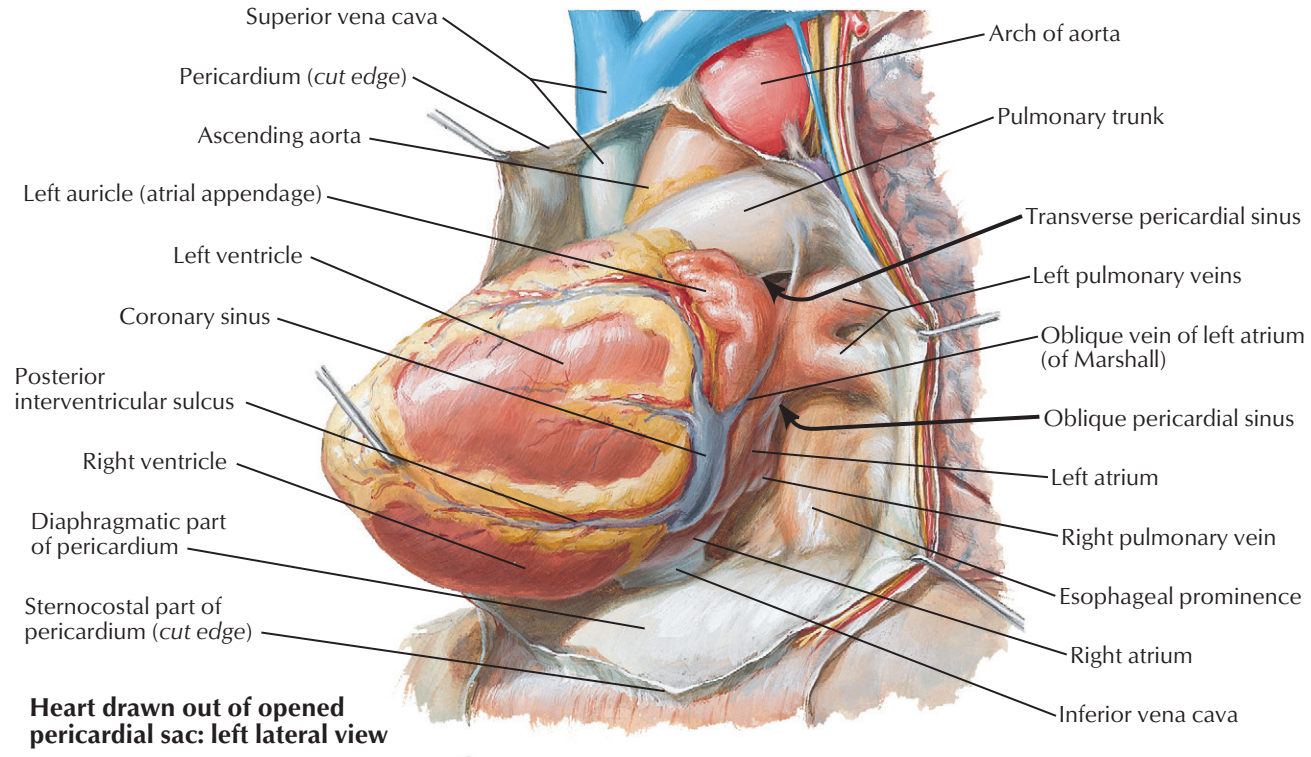




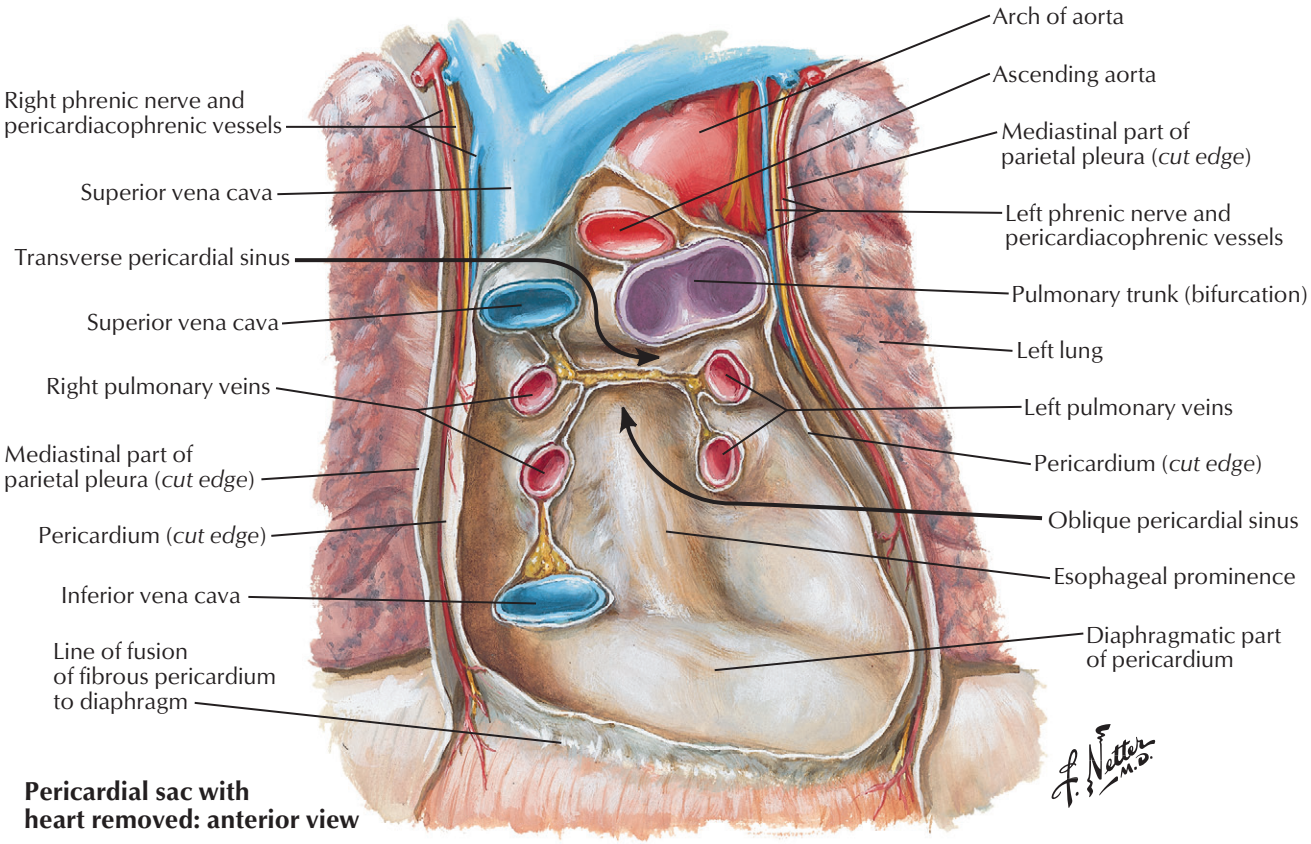
Base of heart: posterior view



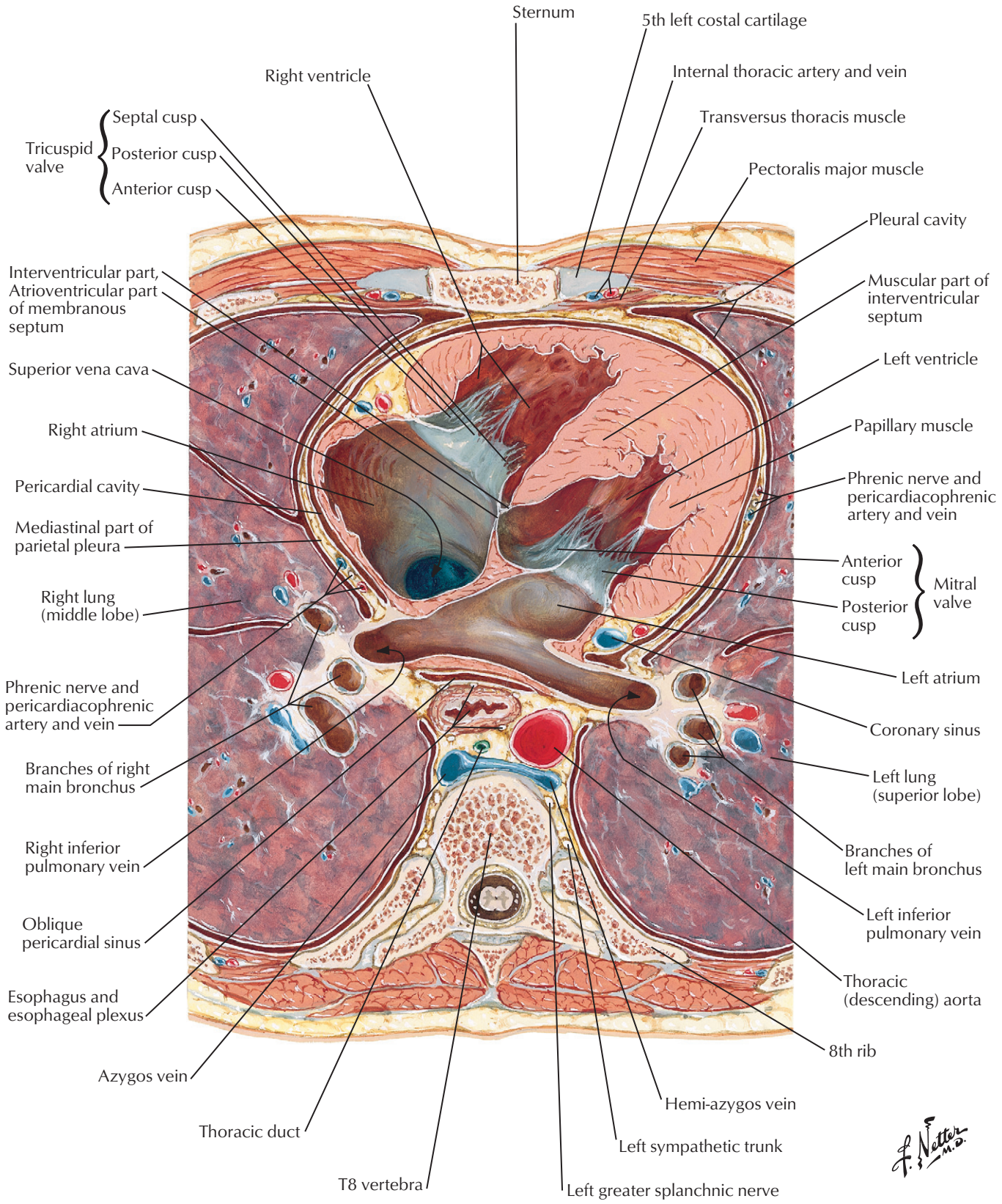
Base and diaphragmatic surface: posteroinferior view

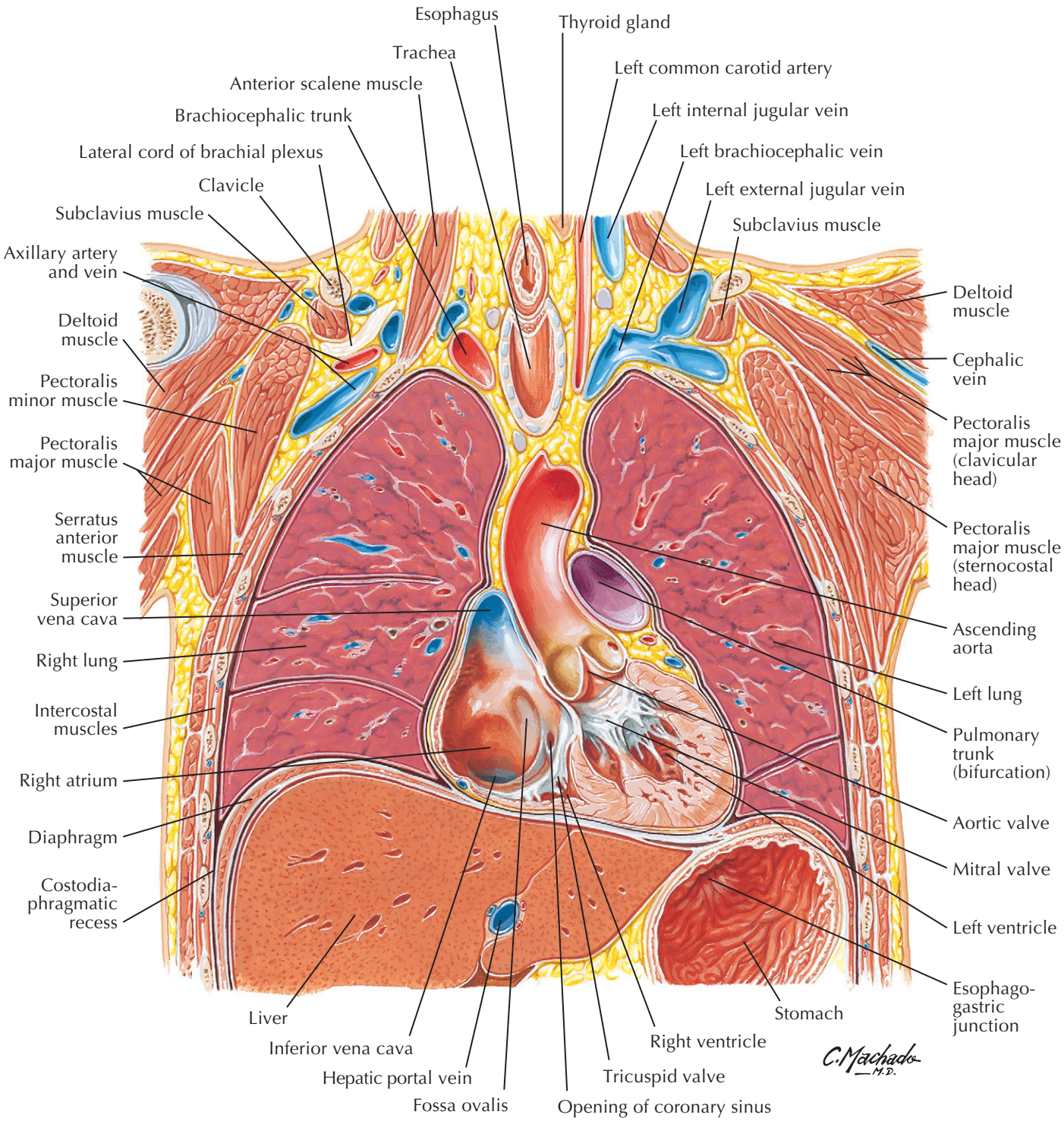


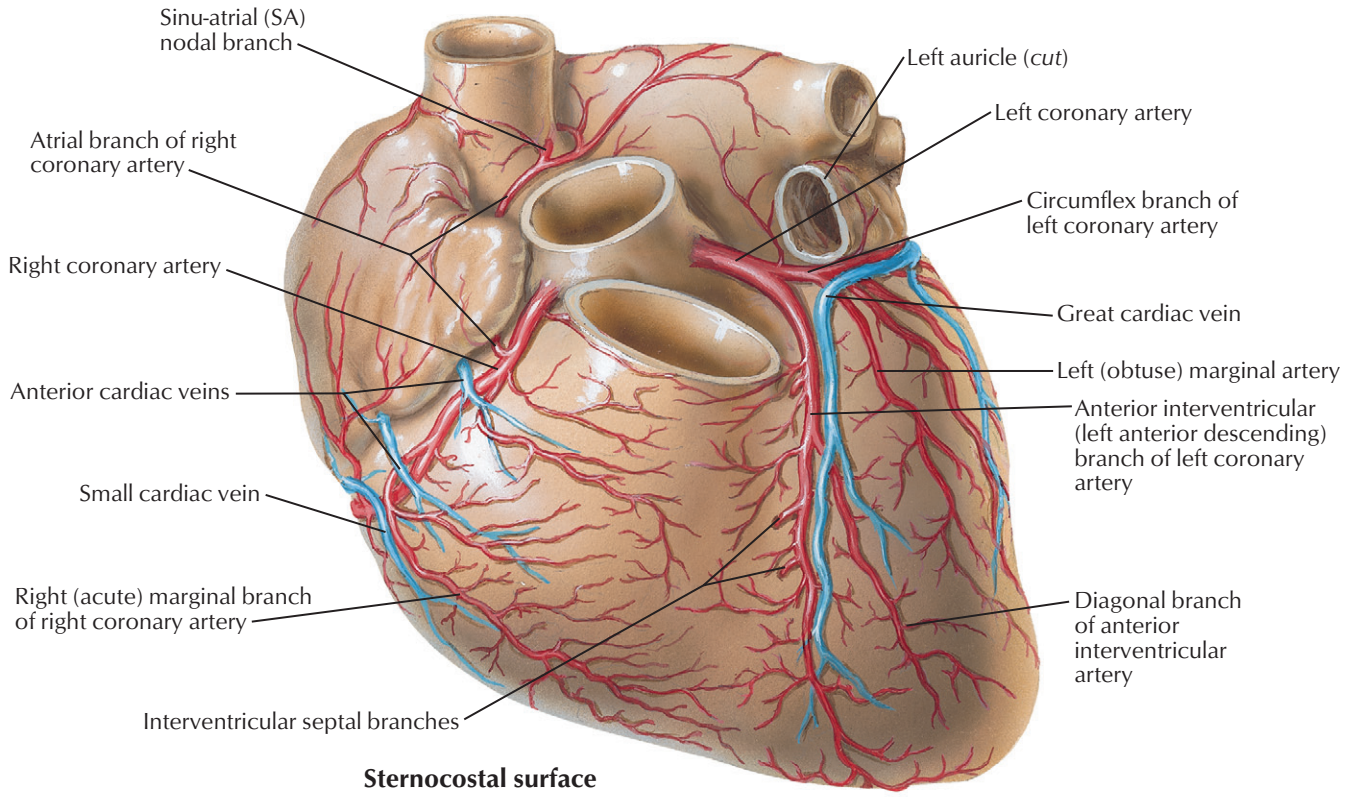
Heart drawn out of opened pericardial sac: left lateral view



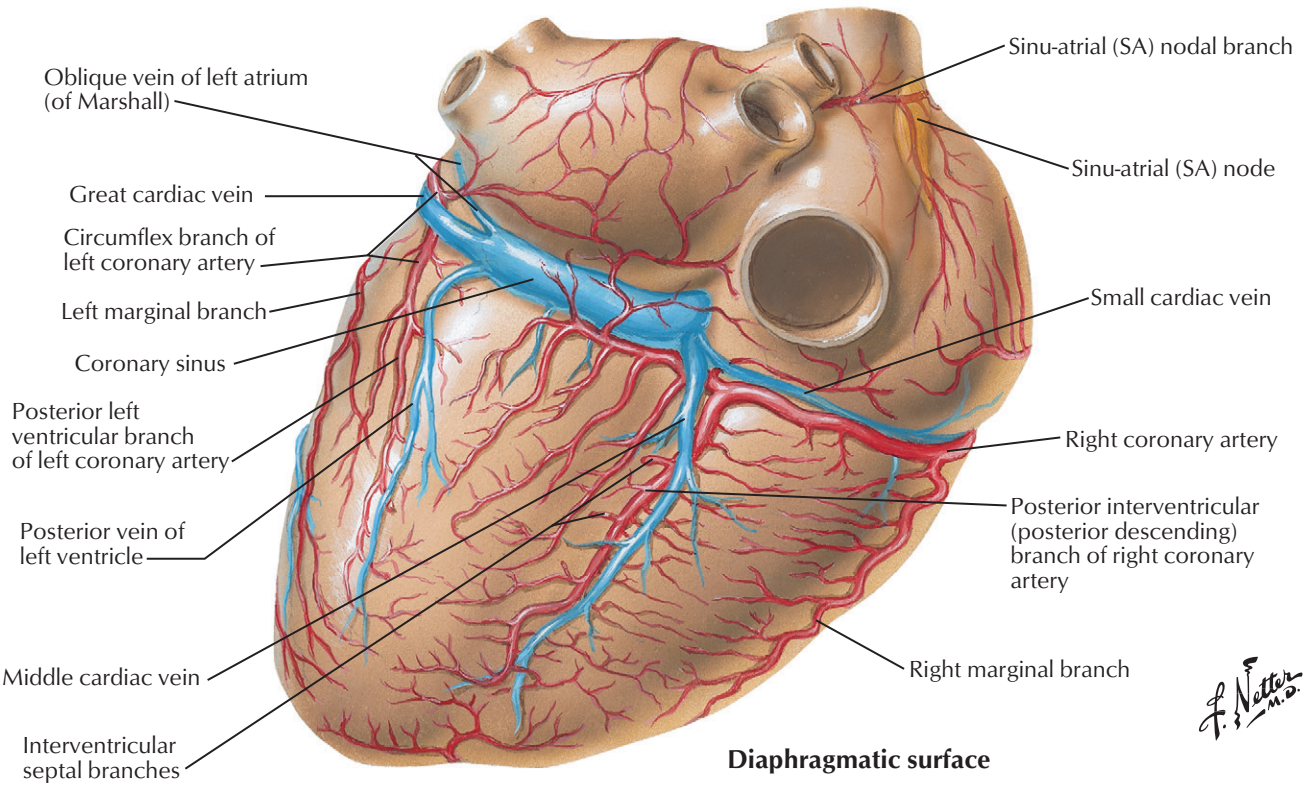
Pericardial sac with heart removed: anterior view


Sternum
5th left costal cartilage
Right ventricle
Internal thoracic artery and vein
Transversus thoracis muscle
Tricuspid valve
Septal cusp
Posterior cusp
Anterior cusp
Pectoralis major muscle
Pleural cavity
Interventricular part, Atrioventricular part of membranous septum
Muscular part of interventricular septum
Superior vena cava
Left ventricle
Right atrium
Papillary muscle
Pericardial cavity
Phrenic nerve and pericardiacophrenic artery and vein
Mediastinal part of parietal pleura
Anterior cusp
Posterior cusp
Mitral valve
Right lung (middle lobe)
Left atrium
Phrenic nerve and pericardiacophrenic artery and vein
Coronary sinus
Branches of right main bronchus
Left lung (superior lobe)
Right inferior pulmonary vein
Branches of left main bronchus
Oblique pericardial sinus
Left inferior pulmonary vein
Thoracic (descending) aorta
Esophagus and esophageal plexus
8th rib
Azygos vein
Hemi-azygos vein
Thoracic duct
Left sympathetic trunk
T8 vertebra
Left greater splanchnic nerve

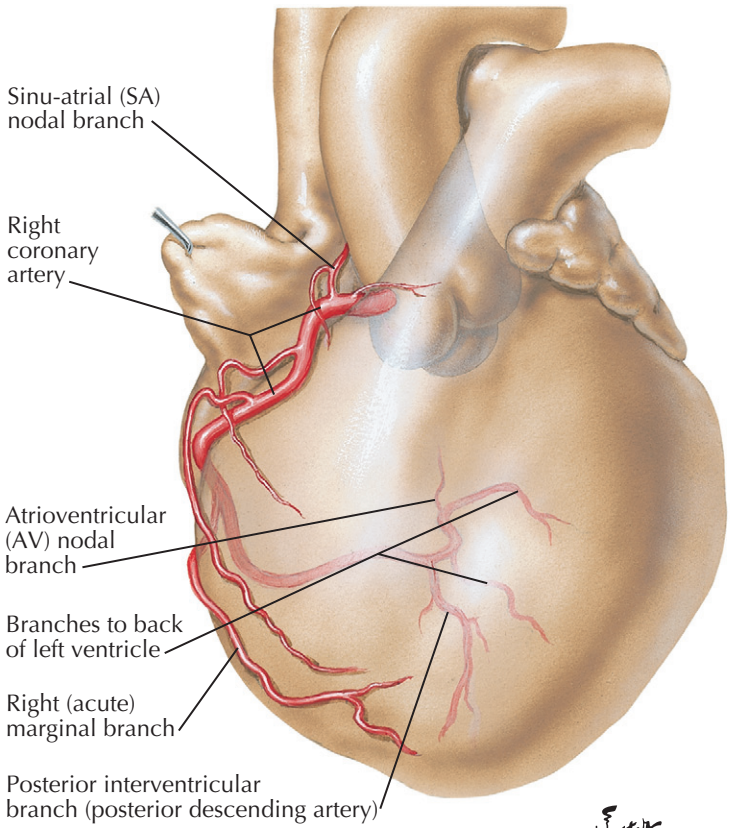

Esophagus
Thyroid gland
Trachea
Left common carotid artery
Anterior scalene muscle
Left internal jugular vein
Brachiocephalic trunk
Left brachiocephalic vein
Lateral cord of brachial plexus
Left external jugular vein
Clavicle
Subclavius muscle
Subclavius muscle
Axillary artery and vein
Deltoid muscle
Deltoid muscle
Cephalic vein
Pectoralis minor muscle
Pectoralis major muscle (clavicular head)
Pectoralis major muscle
Pectoralis major muscle (sternocostal head)
Serratus anterior muscle
Ascending aorta
Superior vena cava
Left lung
Right lung
Pulmonary trunk (bifurcation)
Intercostal muscles
Aortic valve
Right atrium
Mitral valve
Diaphragm
Left ventricle
Costodiaphragmatic recess
Esophagogastric junction
Liver
Stomach
Inferior vena cava
Right ventricle
Hepatic portal vein
Tricuspid valve
Fossa ovalis
Opening of coronary sinus
C. Machado M.D.

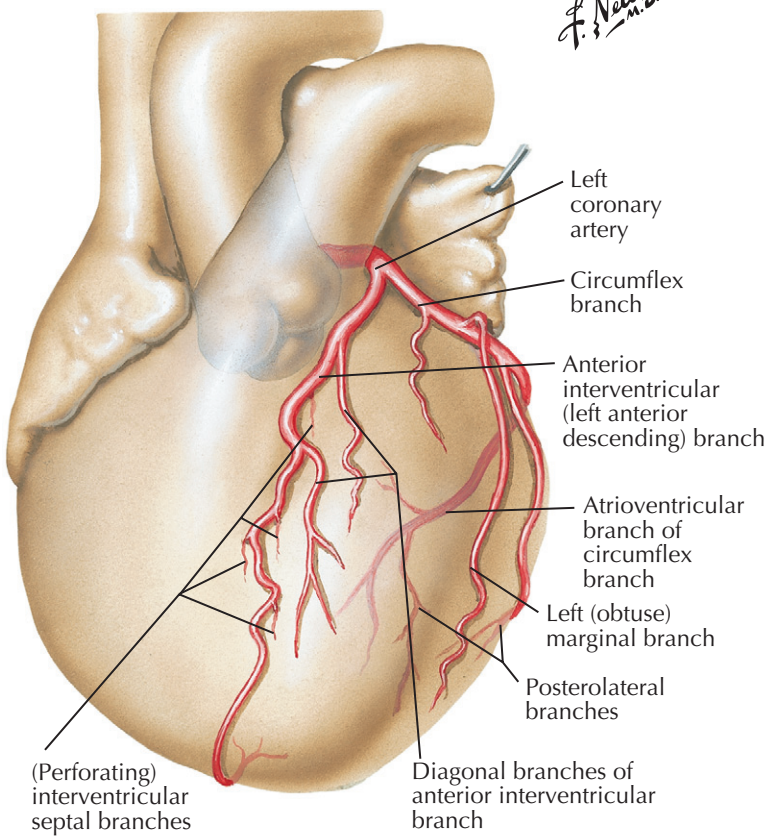


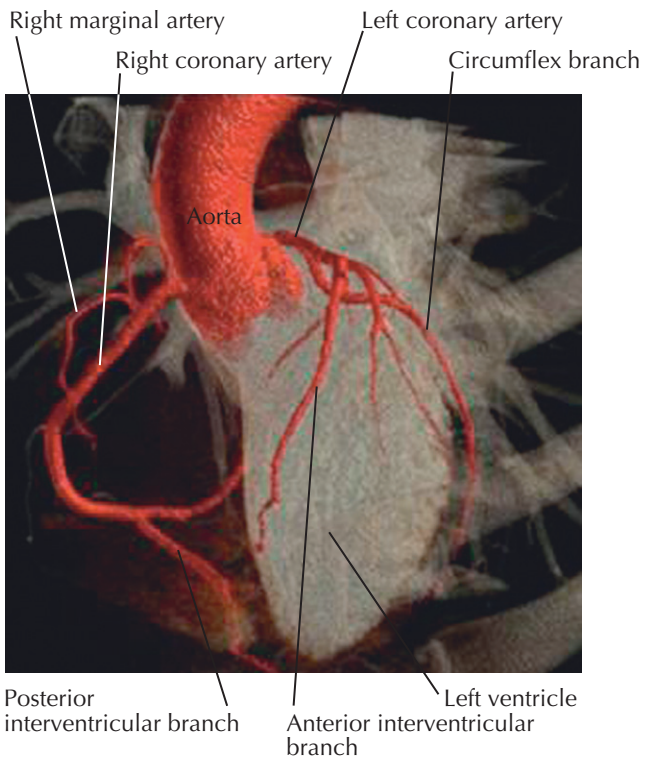
Sternocostal surface

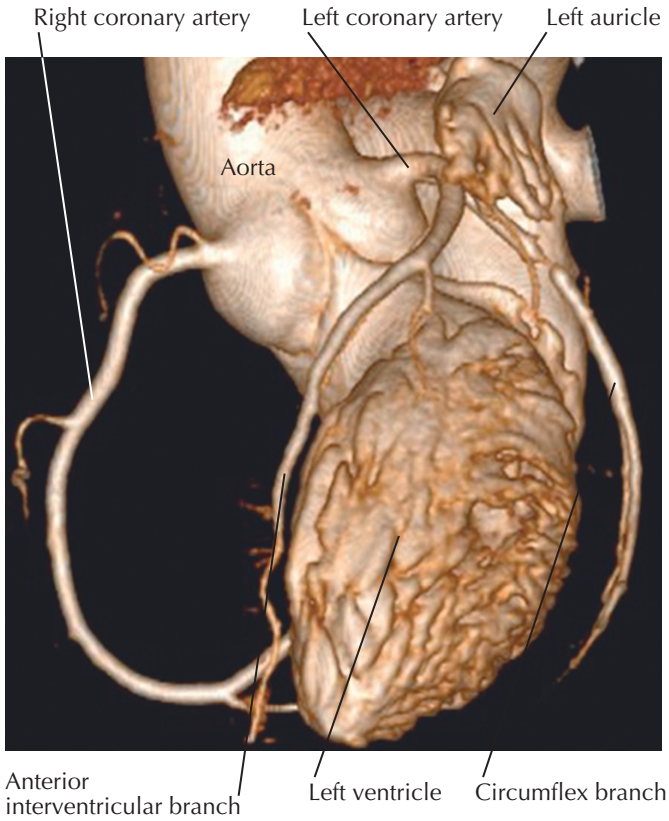


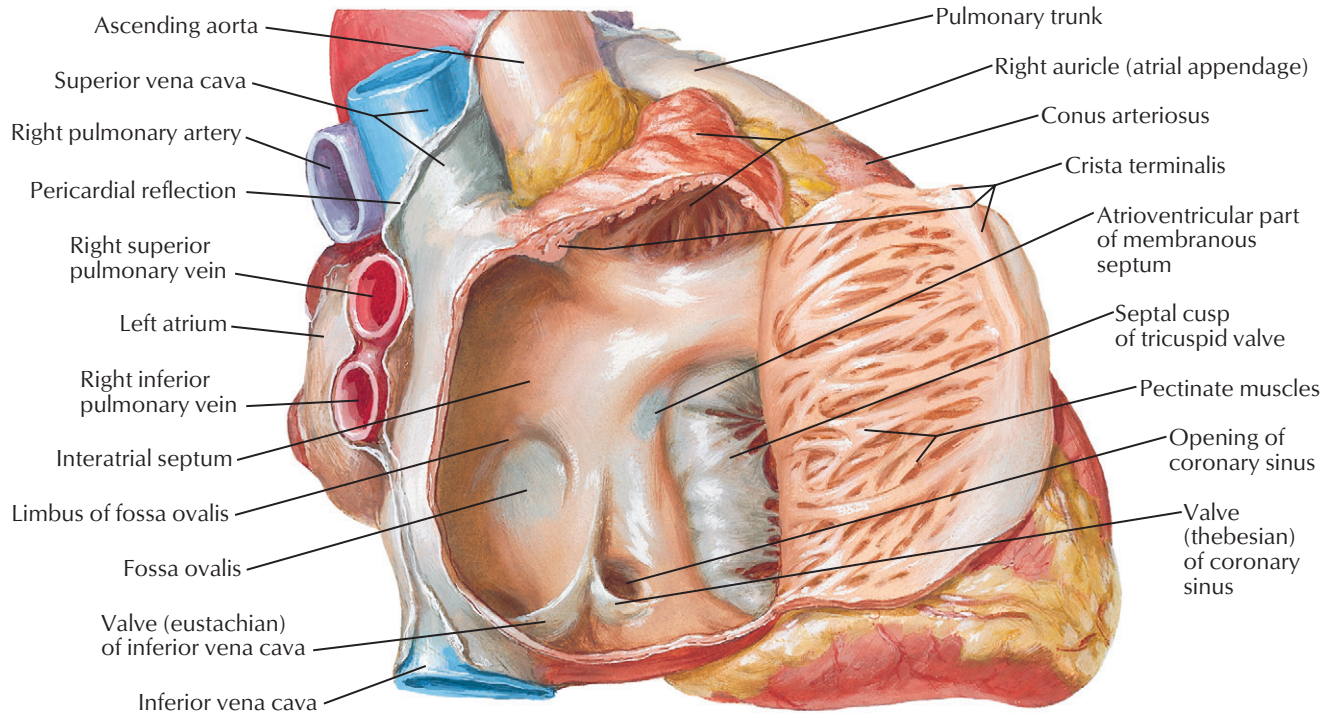
Diaphragmatic surface


Sinu-atrial (SA) nodal branch
Right coronary artery
Atrioventricular (AV) nodal branch
Branches to back of left ventricle
Right (acute) marginal branch
Posterior interventricular branch (posterior descending artery)

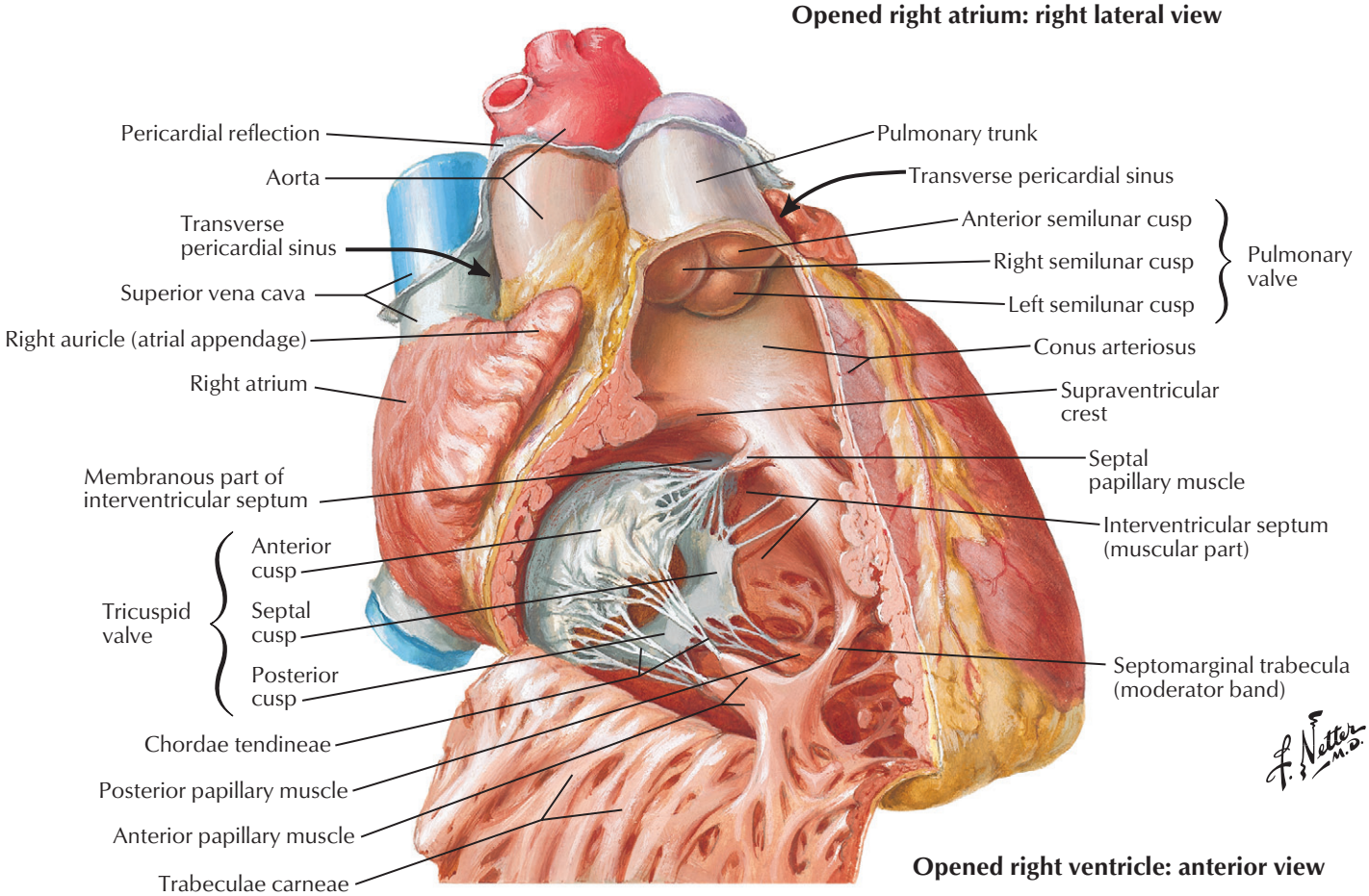

Left coronary artery
Circumflex branch
Anterior interventricular (left anterior descending) branch
Atrioventricular branch of circumflex branch
Left (obtuse) marginal branch
Posterolateral branches
(Perforating) interventricular septal branches
Diagonal branches of anterior interventricular branch


Right marginal artery
Right coronary artery
Left coronary artery
Circumflex branch
Aorta
Posterior interventricular branch
Anterior interventricular branch
Left ventricle

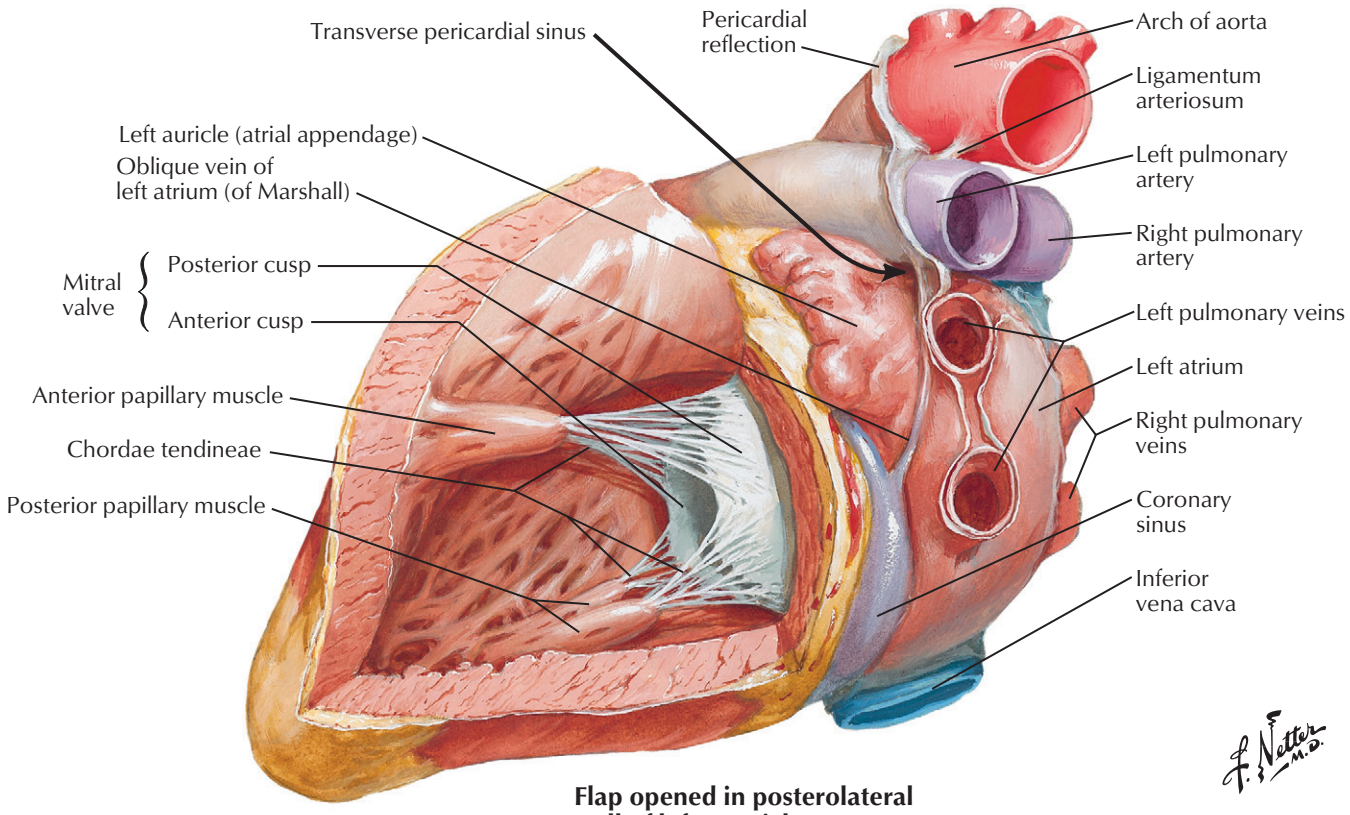

Right coronary artery
Left coronary artery
Left auricle
Aorta
Anterior interventricular branch
Left ventricle
Circumflex branch



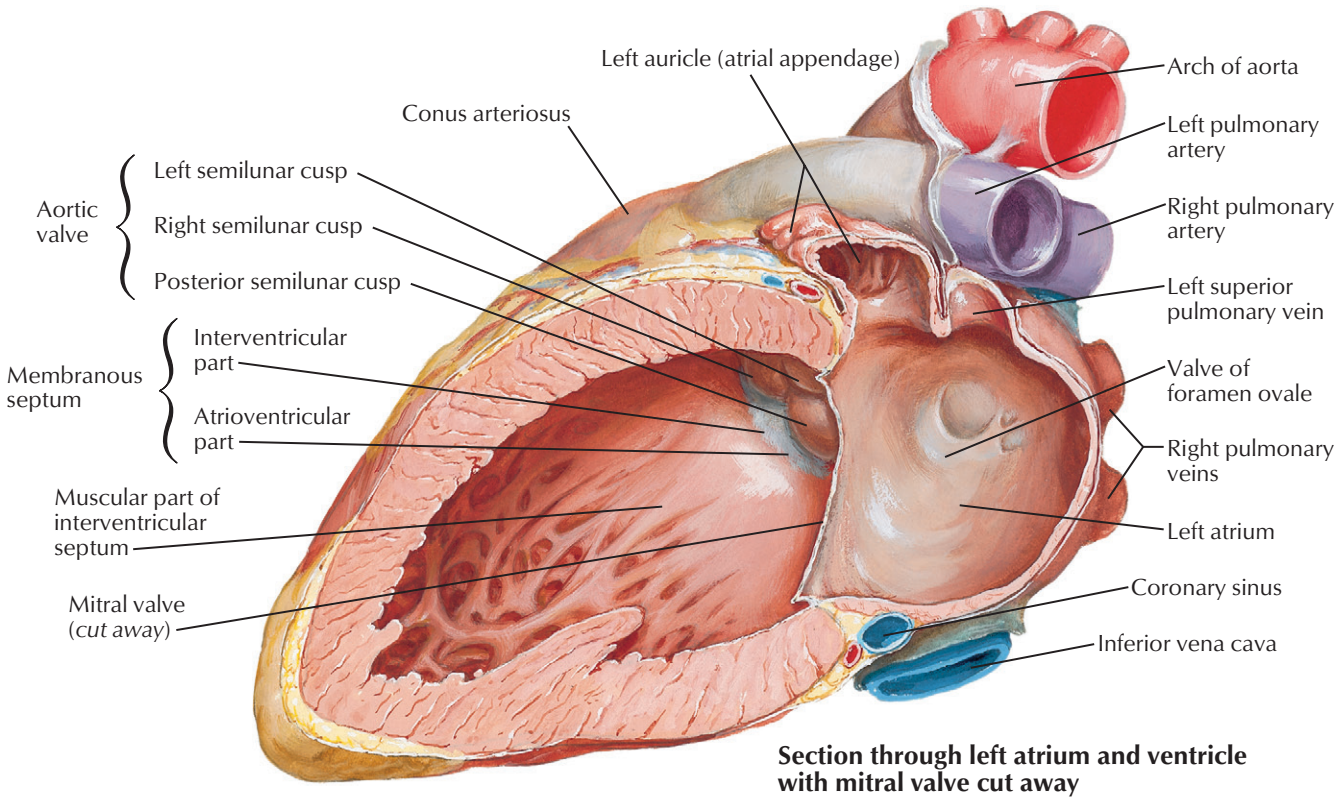
Opened right atrium: right lateral view



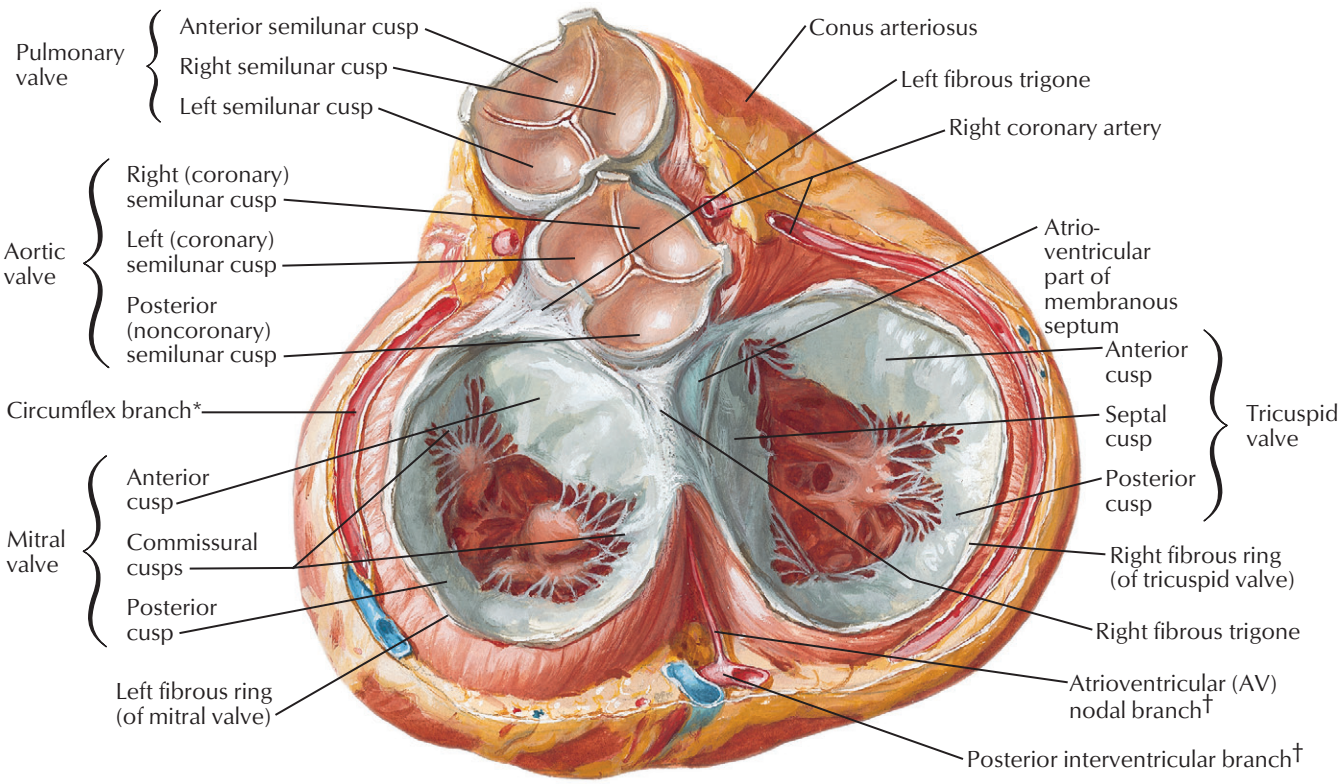
Opened right ventricle: anterior view



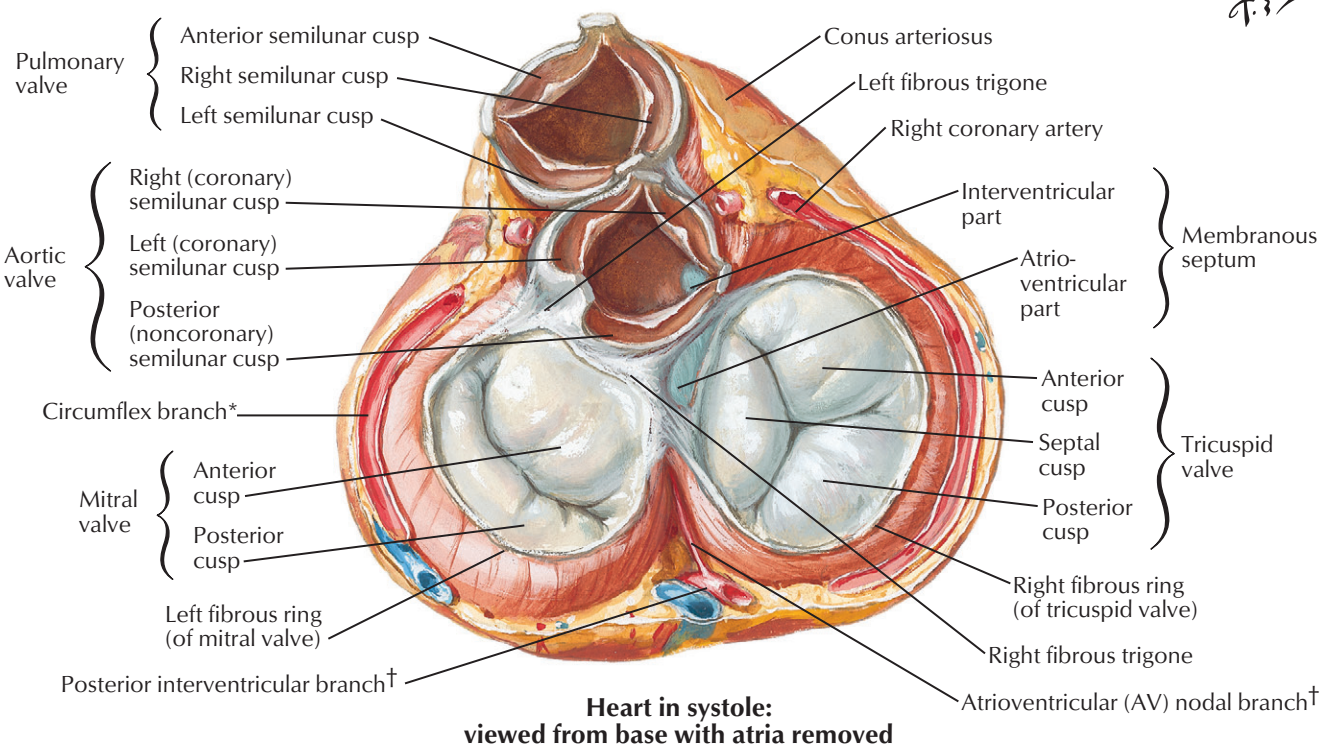
Flap opened in posterolateral wall of left ventricle



Section through left atrium and ventricle with mitral valve cut away

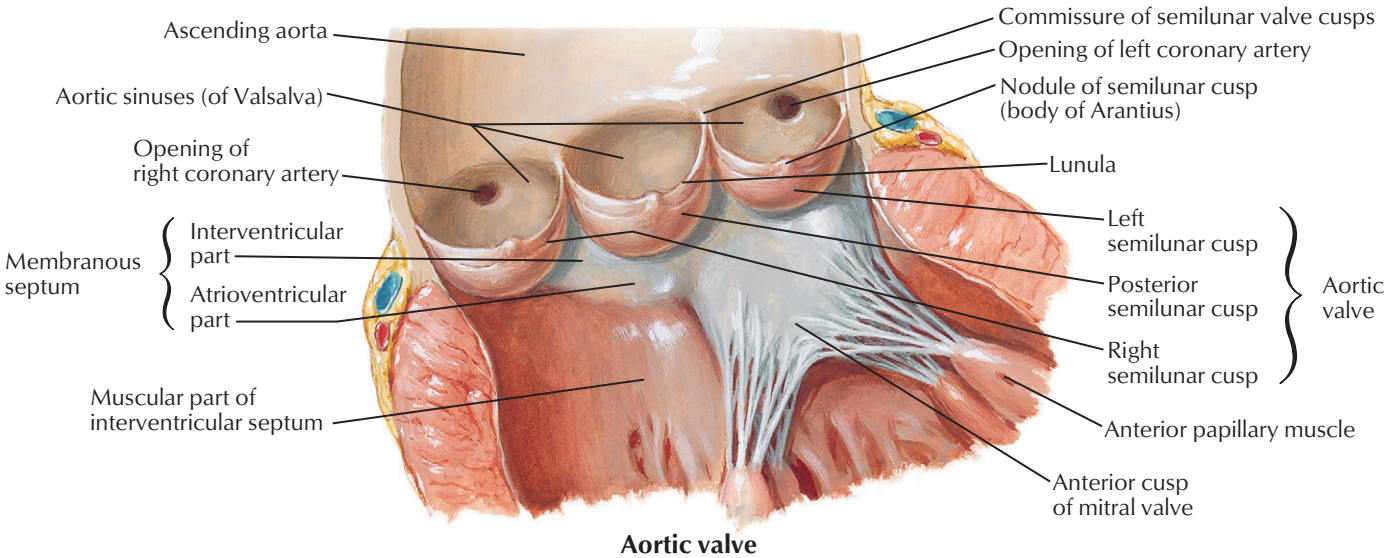


Heart in diastole:
viewed from base with atria removed

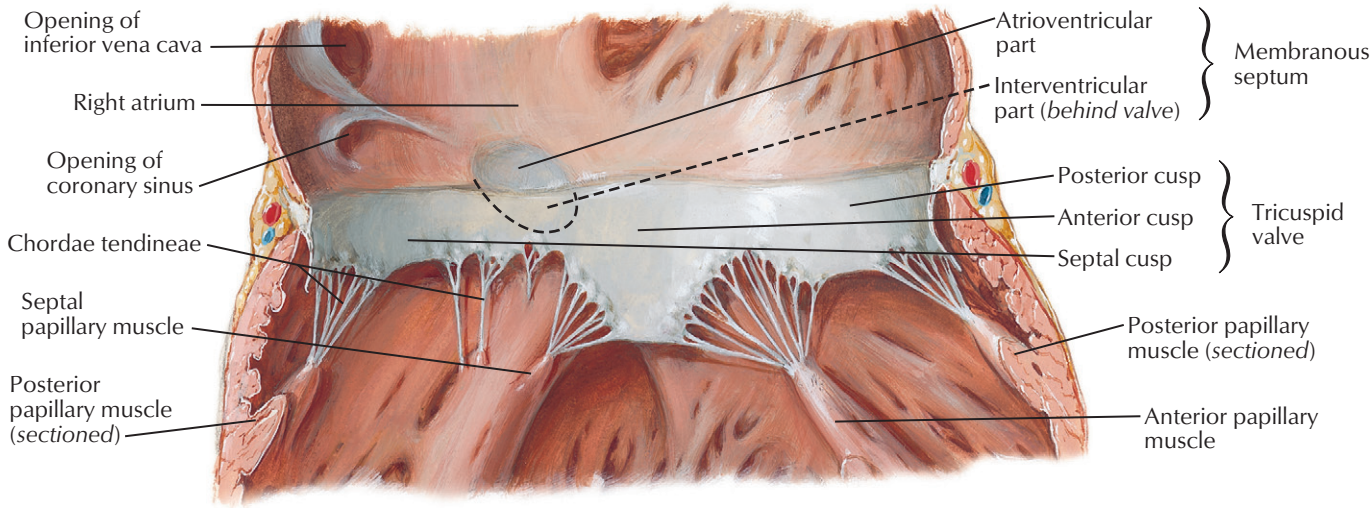


Heart in systole:
viewed from base with atria removed

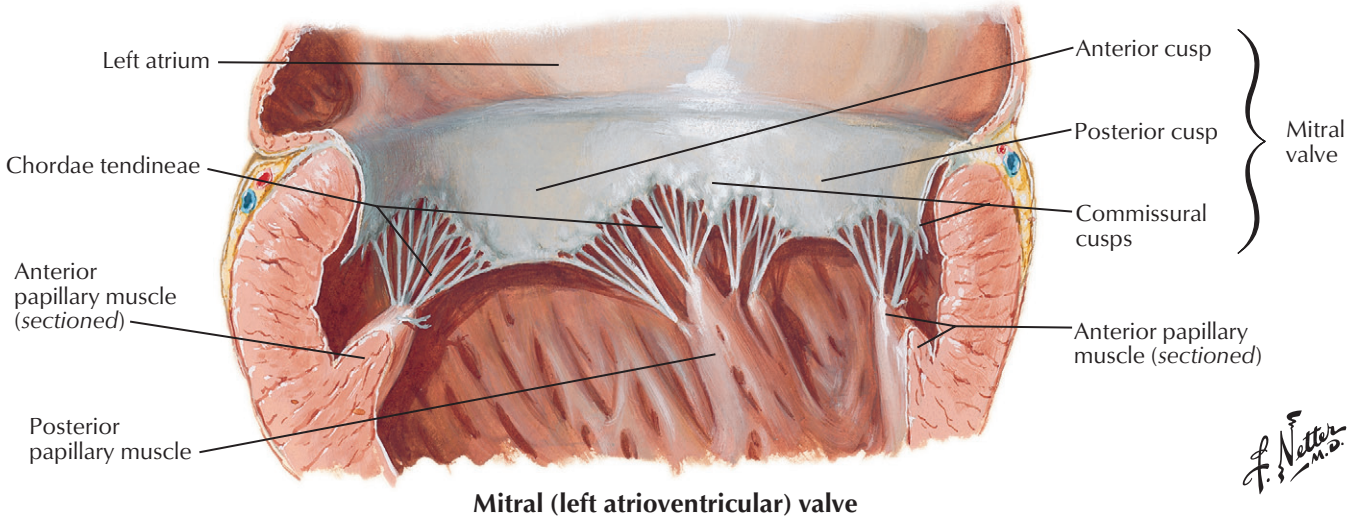
*Of left coronary artery
†Of right coronary artery



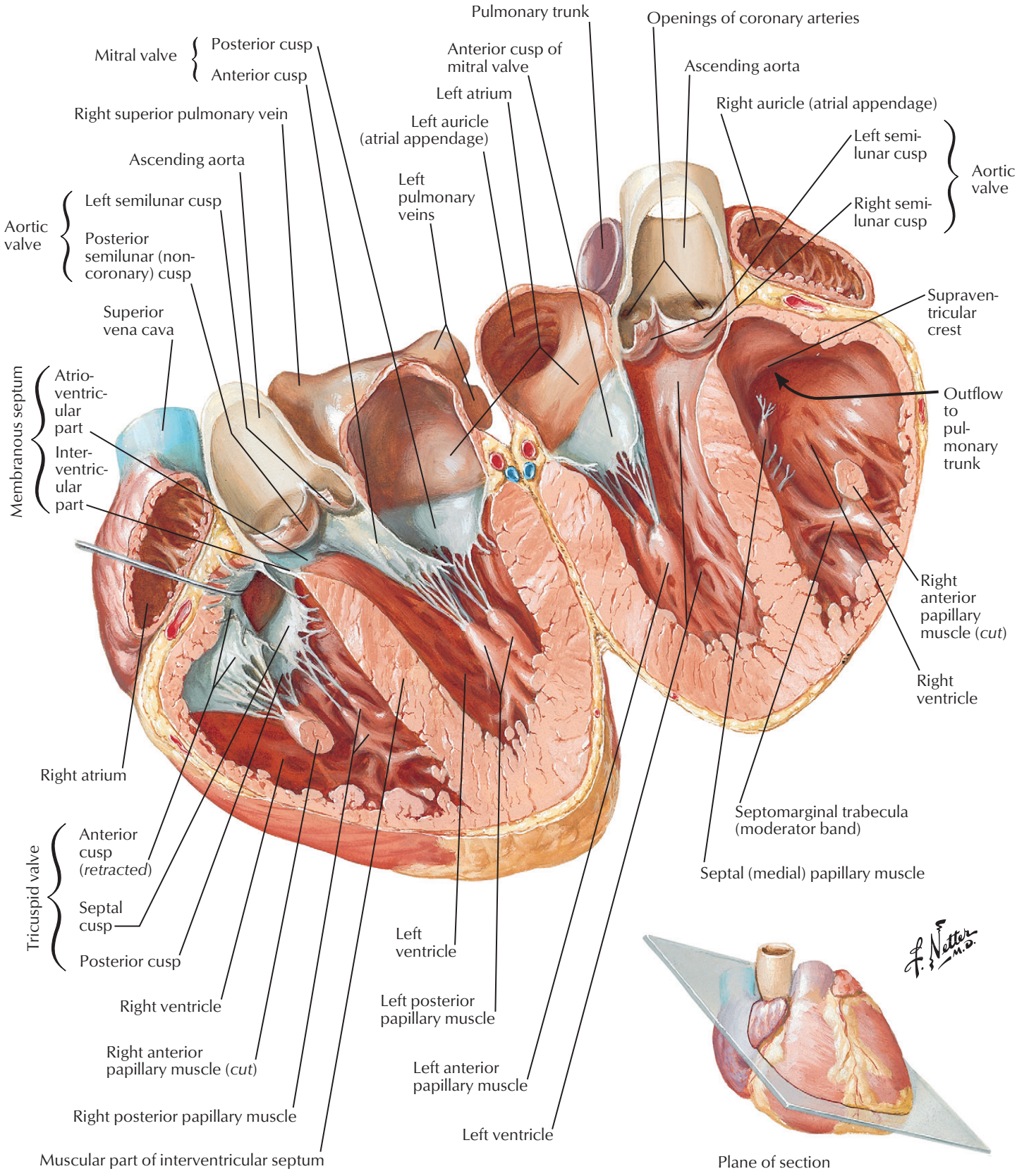
Aortic valve

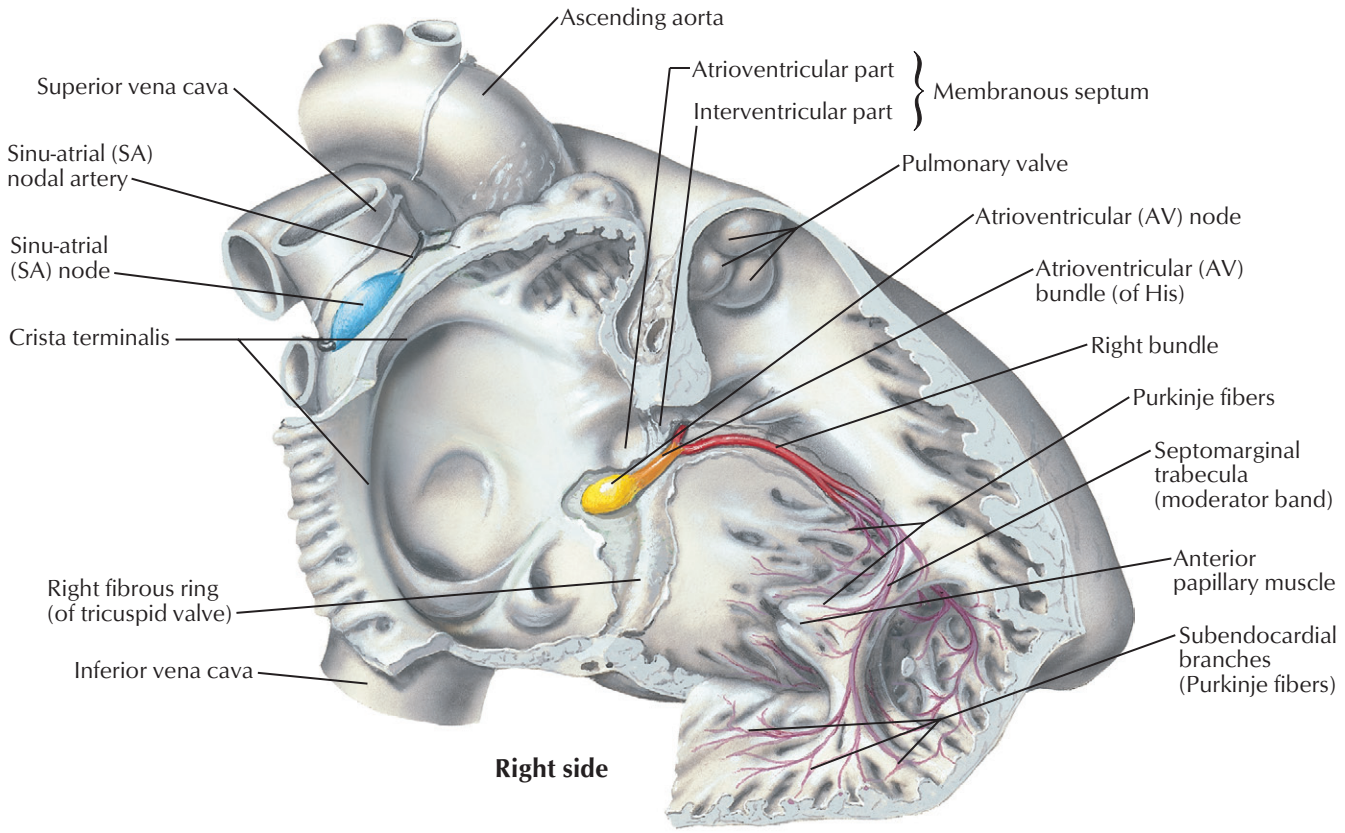


Tricuspid (right atrioventricular) valve

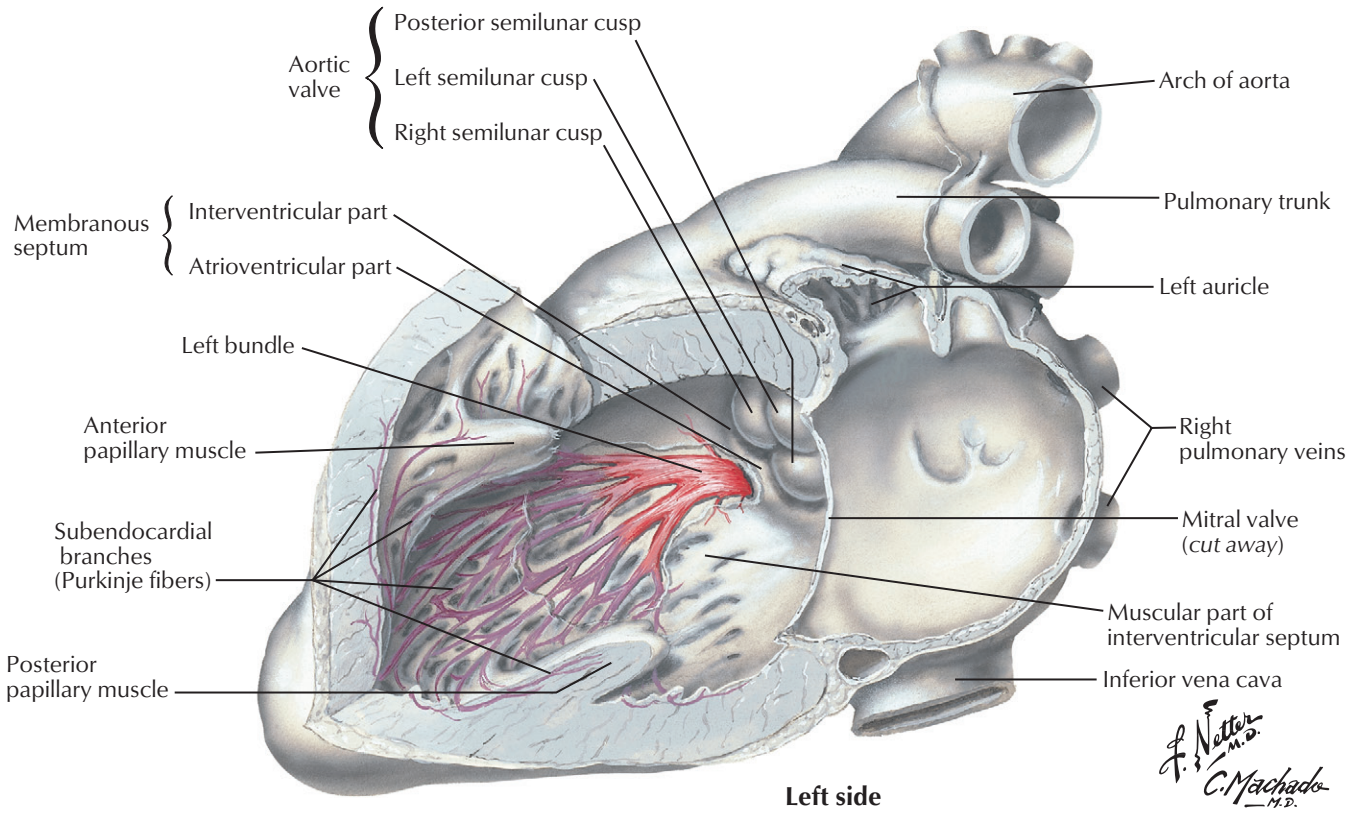


Mitral (left atrioventricular) valve

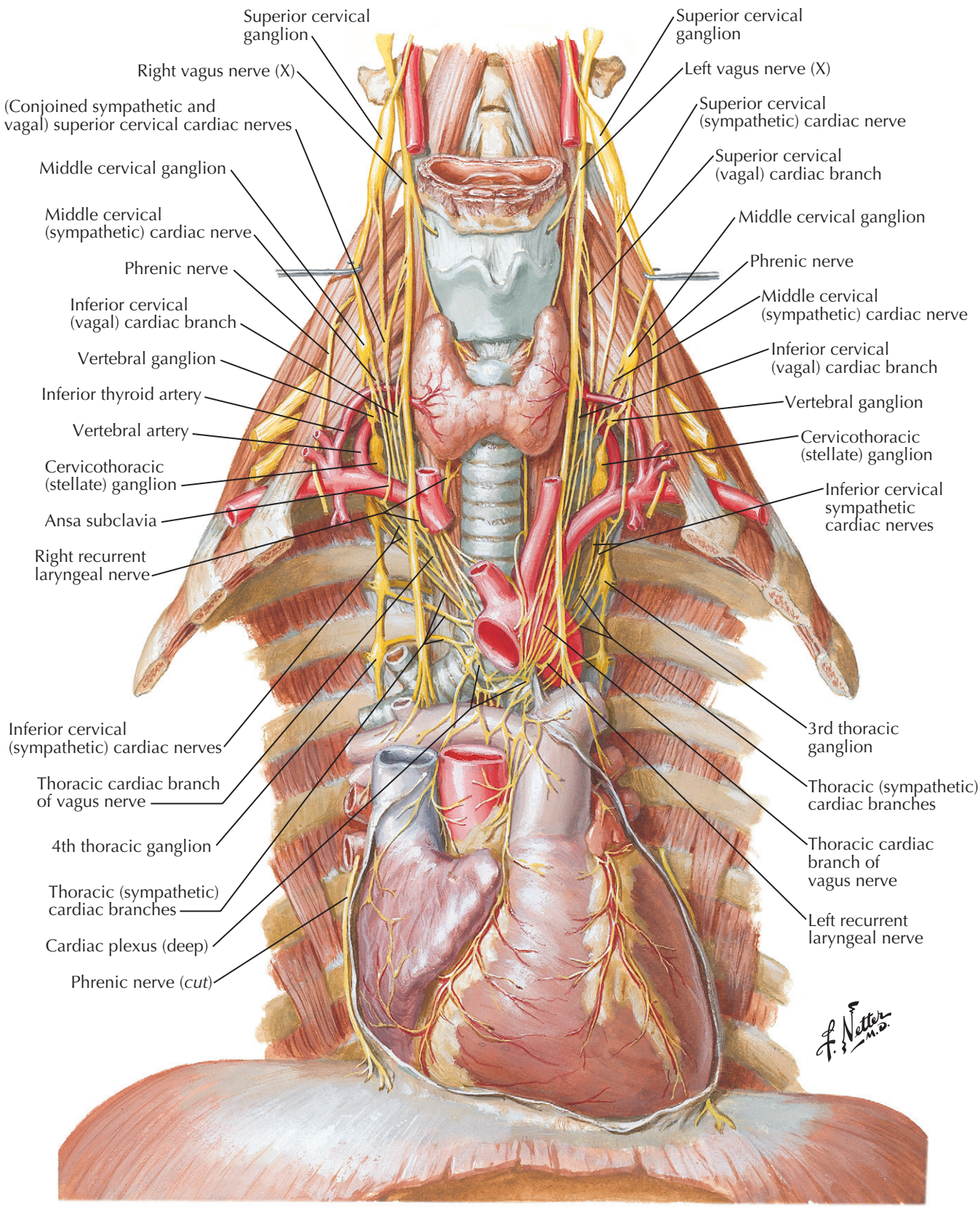

Pulmonary trunk
Openings of coronary arteries
Mitral valve
Posterior cusp
Anterior cusp
Anterior cusp of mitral valve
Ascending aorta
Left atrium
Right auricle (atrial appendage)
Right superior pulmonary vein
Left auricle (atrial appendage)
Left semi-lunar cusp
Aortic valve
Right semi-lunar cusp
Ascending aorta
Left pulmonary veins
Aortic valve
Left semilunar cusp
Posterior semilunar (non-coronary) cusp
Supraventricular crest
Superior vena cava
Membranous septum
Atrioventricular part
Interventricular part
Outflow to pulmonary trunk
Right anterior papillary muscle (cut)
Right ventricle
Right atrium
Septomarginal trabecula (moderator band)
Septal (medial) papillary muscle
Tricuspid valve
Anterior cusp (retracted)
Septal cusp
Posterior cusp
Left ventricle
Right ventricle
Left posterior papillary muscle
Right anterior papillary muscle (cut)
Left anterior papillary muscle
Right posterior papillary muscle
Left ventricle
Muscular part of interventricular septum
Plane of section

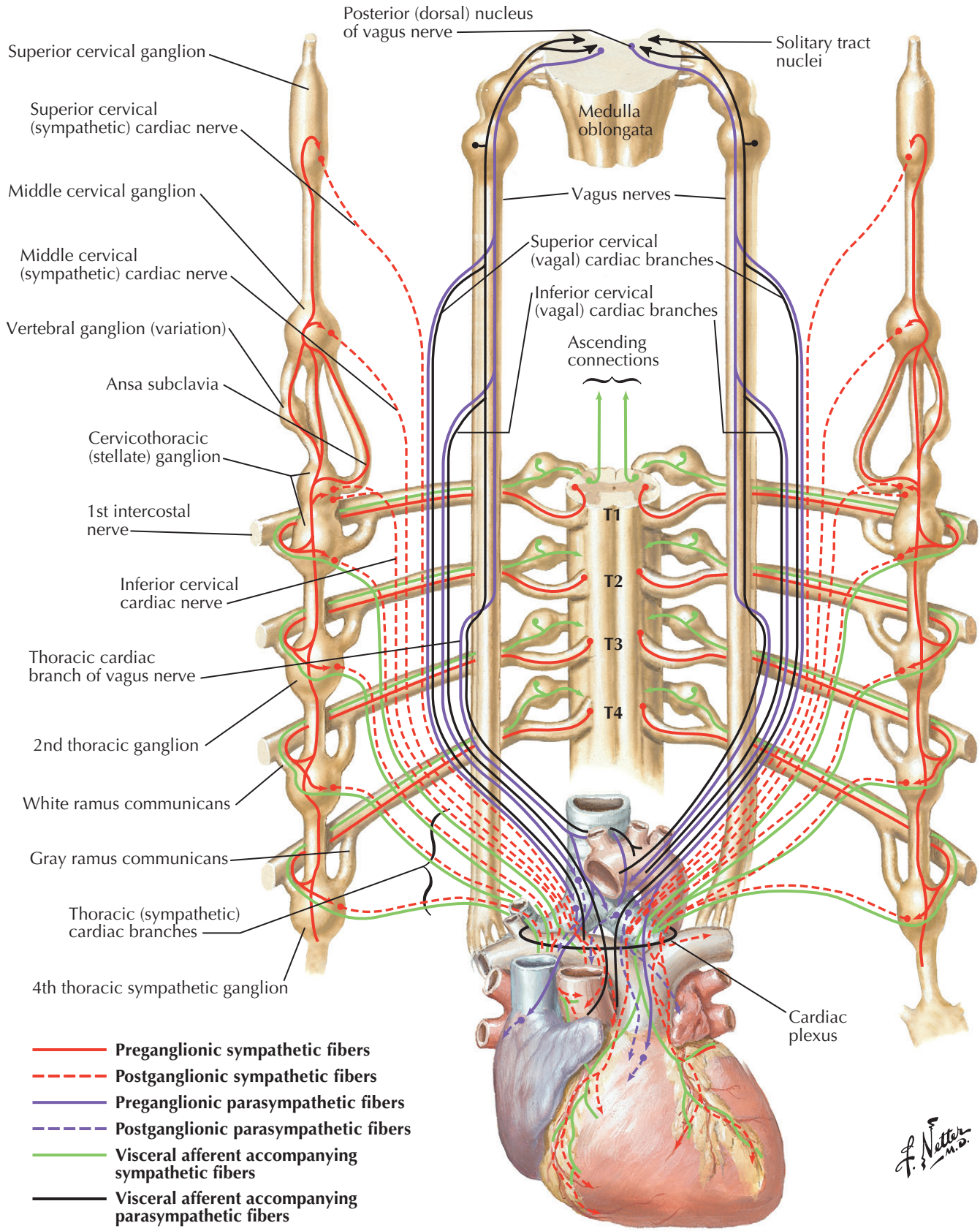


Right side

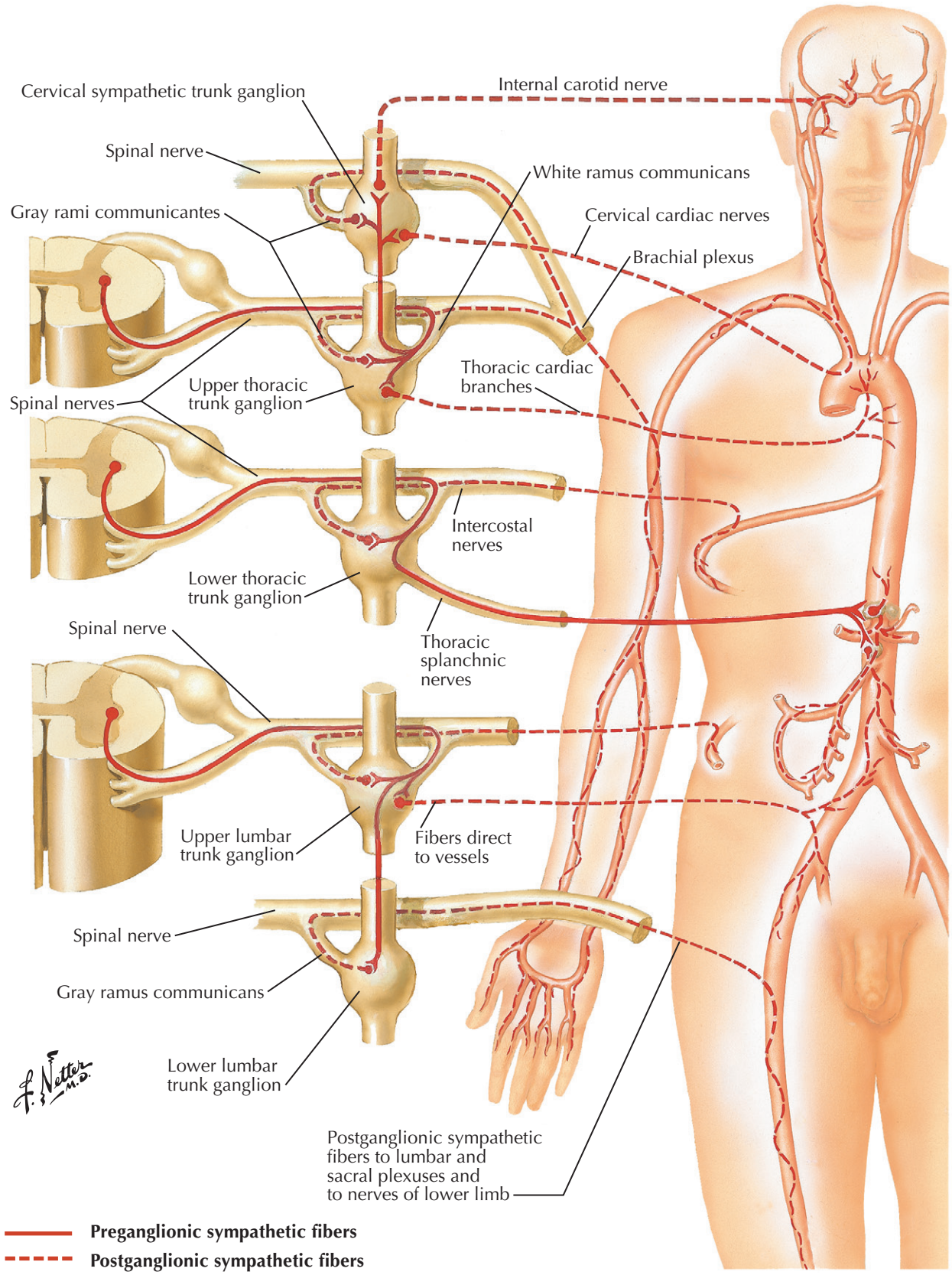


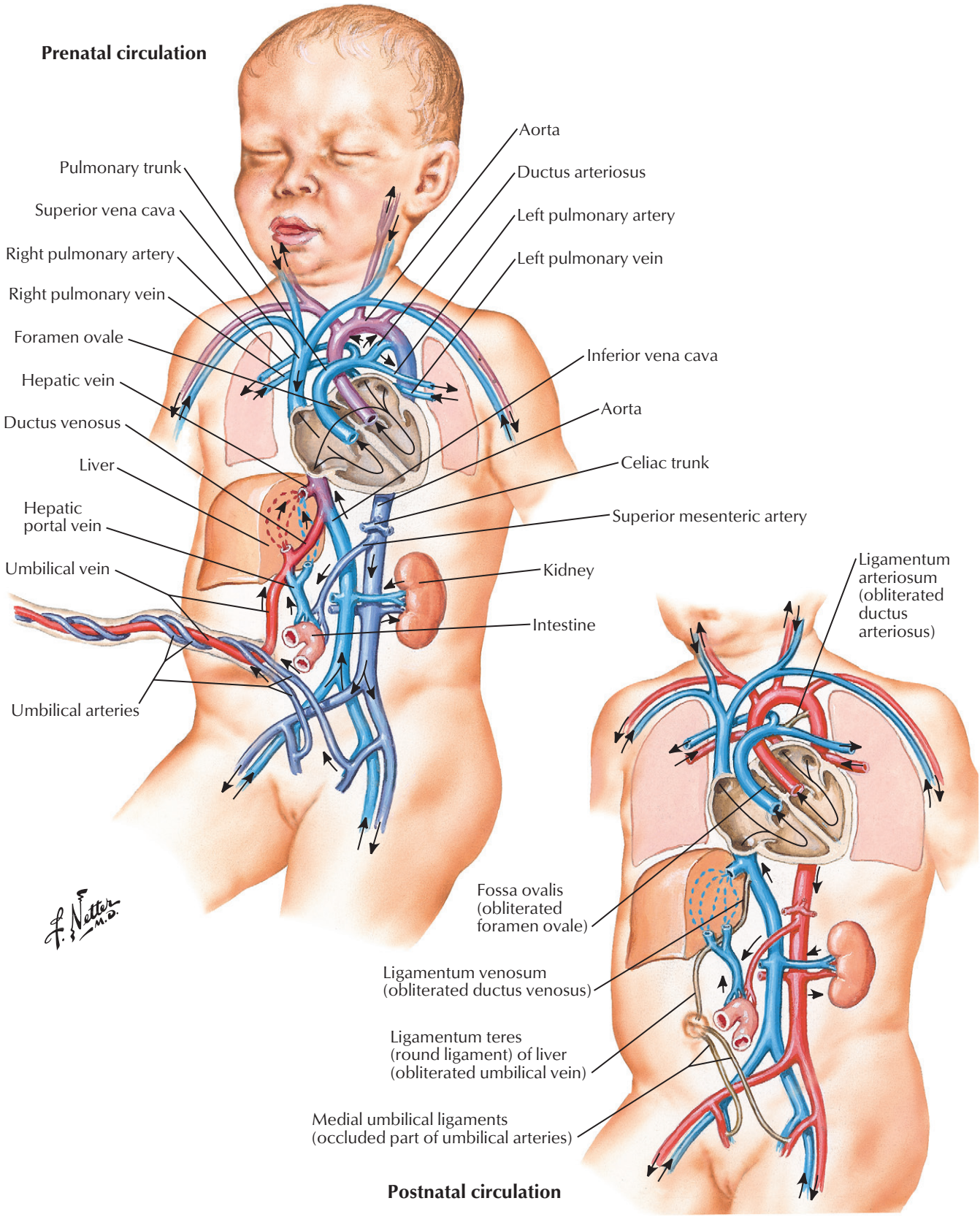
Left side

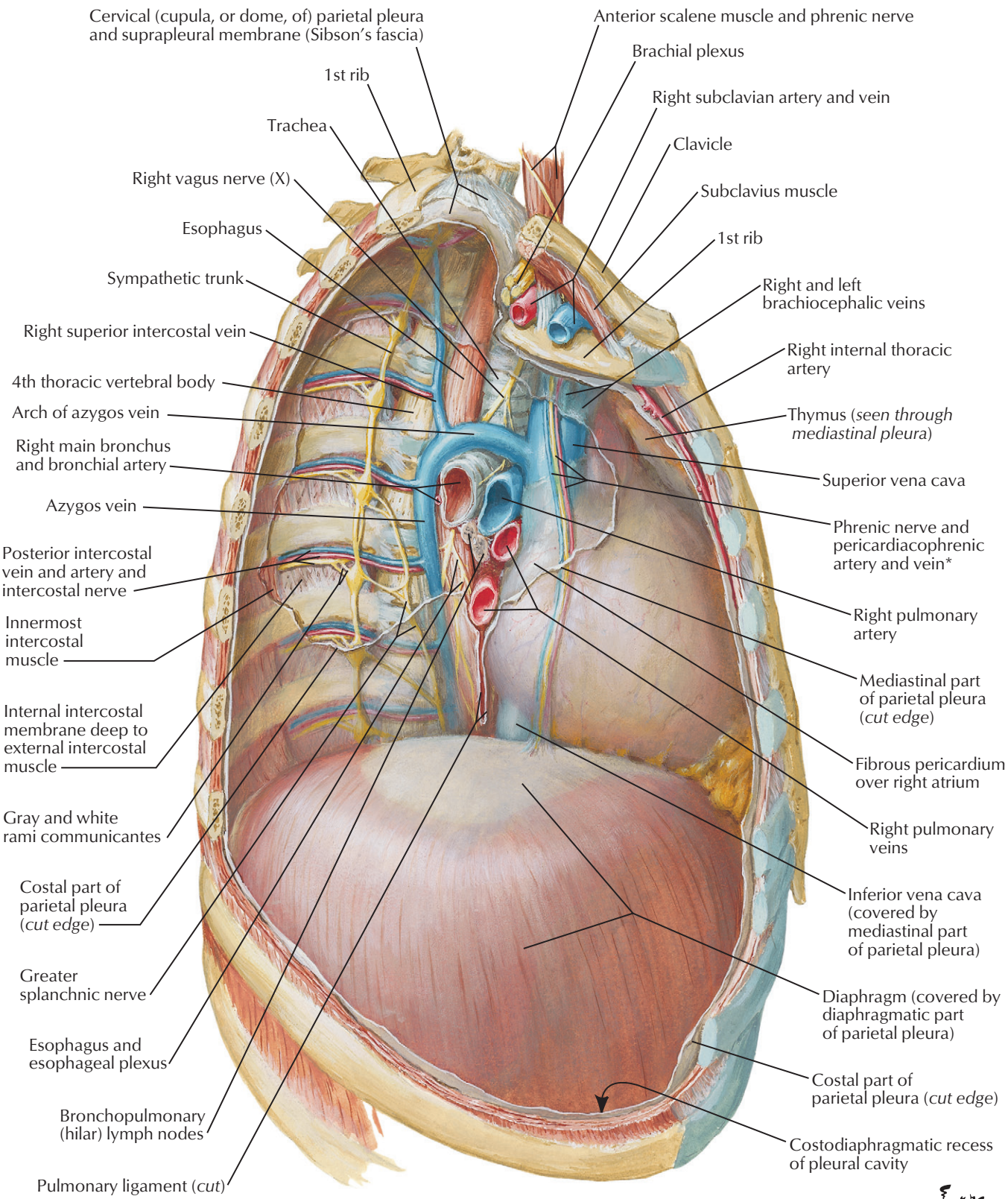

Superior cervical ganglion
Right vagus nerve (X)
(Conjoined sympathetic and vagal) superior cervical cardiac nerves
Middle cervical ganglion
Middle cervical (sympathetic) cardiac nerve
Phrenic nerve
Inferior cervical (vagal) cardiac branch
Vertebral ganglion
Inferior thyroid artery
Vertebral artery
Cervicothoracic (stellate) ganglion
Ansa subclavia
Right recurrent laryngeal nerve
Inferior cervical (sympathetic) cardiac nerves
Thoracic cardiac branch of vagus nerve
4th thoracic ganglion
Thoracic (sympathetic) cardiac branches
Cardiac plexus (deep)
Phrenic nerve (cut)
Superior cervical ganglion
Left vagus nerve (X)
Superior cervical (sympathetic) cardiac nerve
Superior cervical (vagal) cardiac branch
Middle cervical ganglion
Phrenic nerve
Middle cervical (sympathetic) cardiac nerve
Inferior cervical (vagal) cardiac branch
Vertebral ganglion
Cervicothoracic (stellate) ganglion
Inferior cervical sympathetic cardiac nerves
3rd thoracic ganglion
Thoracic (sympathetic) cardiac branches
Thoracic cardiac branch of vagus nerve
Left recurrent laryngeal nerve


Posterior (dorsal) nucleus of vagus nerve
Solitary tract nuclei
Superior cervical ganglion
Medulla oblongata
Superior cervical (sympathetic) cardiac nerve
Middle cervical ganglion
Vagus nerves
Middle cervical (sympathetic) cardiac nerve
Superior cervical (vagal) cardiac branches
Inferior cervical (vagal) cardiac branches
Vertebral ganglion (variation)
Ascending connections
Ansa subclavia
Cervicothoracic (stellate) ganglion
T1
1st intercostal nerve
T2
Inferior cervical cardiac nerve
T3
Thoracic cardiac branch of vagus nerve
T4
2nd thoracic ganglion
White ramus communicans
Gray ramus communicans
Thoracic (sympathetic) cardiac branches
4th thoracic sympathetic ganglion
Cardiac plexus
Preganglionic sympathetic fibers
Postganglionic sympathetic fibers
Preganglionic parasympathetic fibers
Postganglionic parasympathetic fibers
Visceral afferent accompanying sympathetic fibers
Visceral afferent accompanying parasympathetic fibers
F. Netter M.D.

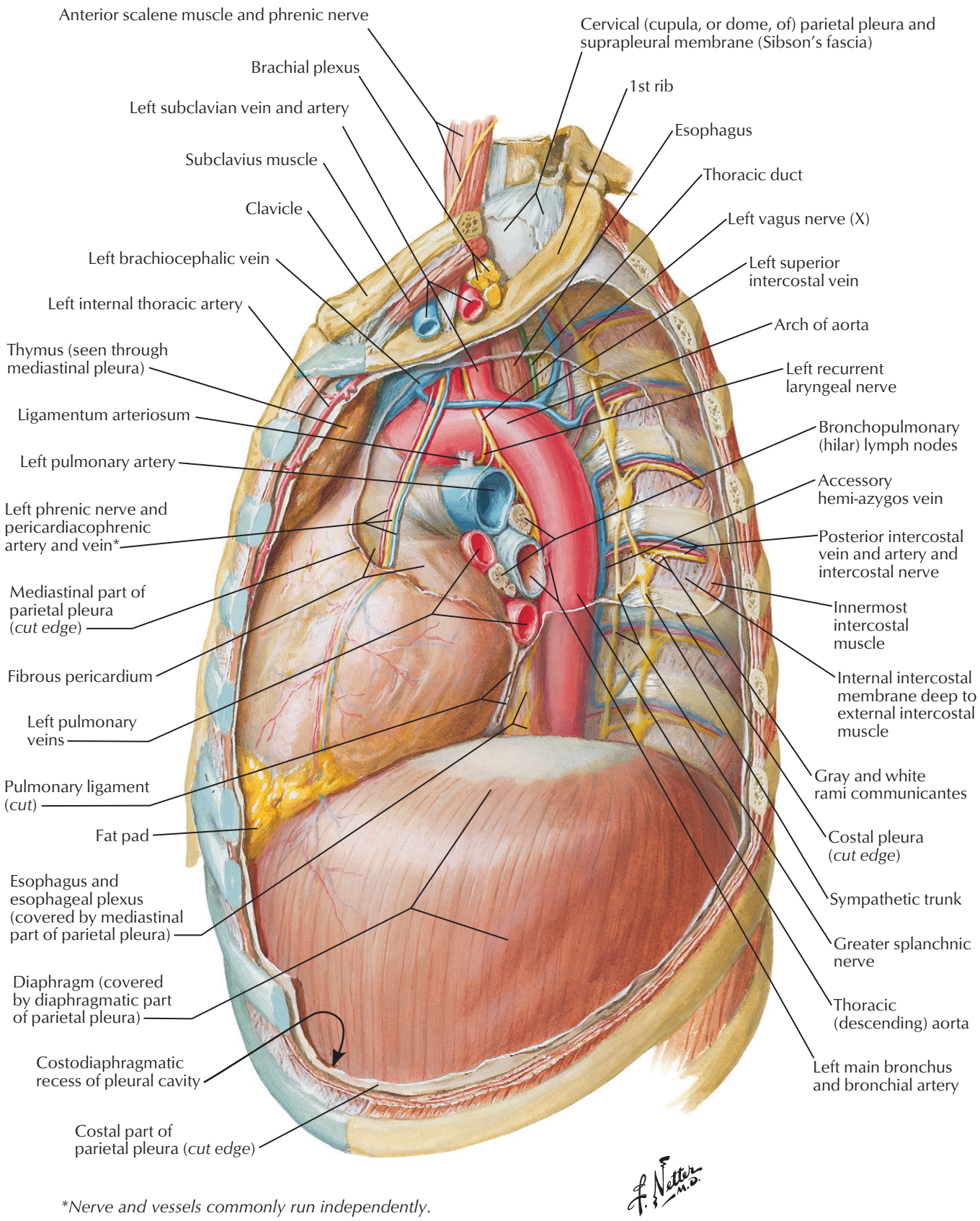
Innervation of Blood Vessels: Schema




Prenatal circulation
Pulmonary trunk
Superior vena cava
Right pulmonary artery
Right pulmonary vein
Foramen ovale
Hepatic vein
Ductus venosus
Liver
Hepatic portal vein
Umbilical vein
Umbilical arteries
Aorta
Ductus arteriosus
Left pulmonary artery
Left pulmonary vein
Inferior vena cava
Aorta
Celiac trunk
Superior mesenteric artery
Kidney
Intestine
F. Netter M.D.
Ligamentum arteriosum (obliterated ductus arteriosus)
Fossa ovalis (obliterated foramen ovale)
Ligamentum venosum (obliterated ductus venosus)
Ligamentum teres (round ligament) of liver (obliterated umbilical vein)
Medial umbilical ligaments (occluded part of umbilical arteries)
Postnatal circulation

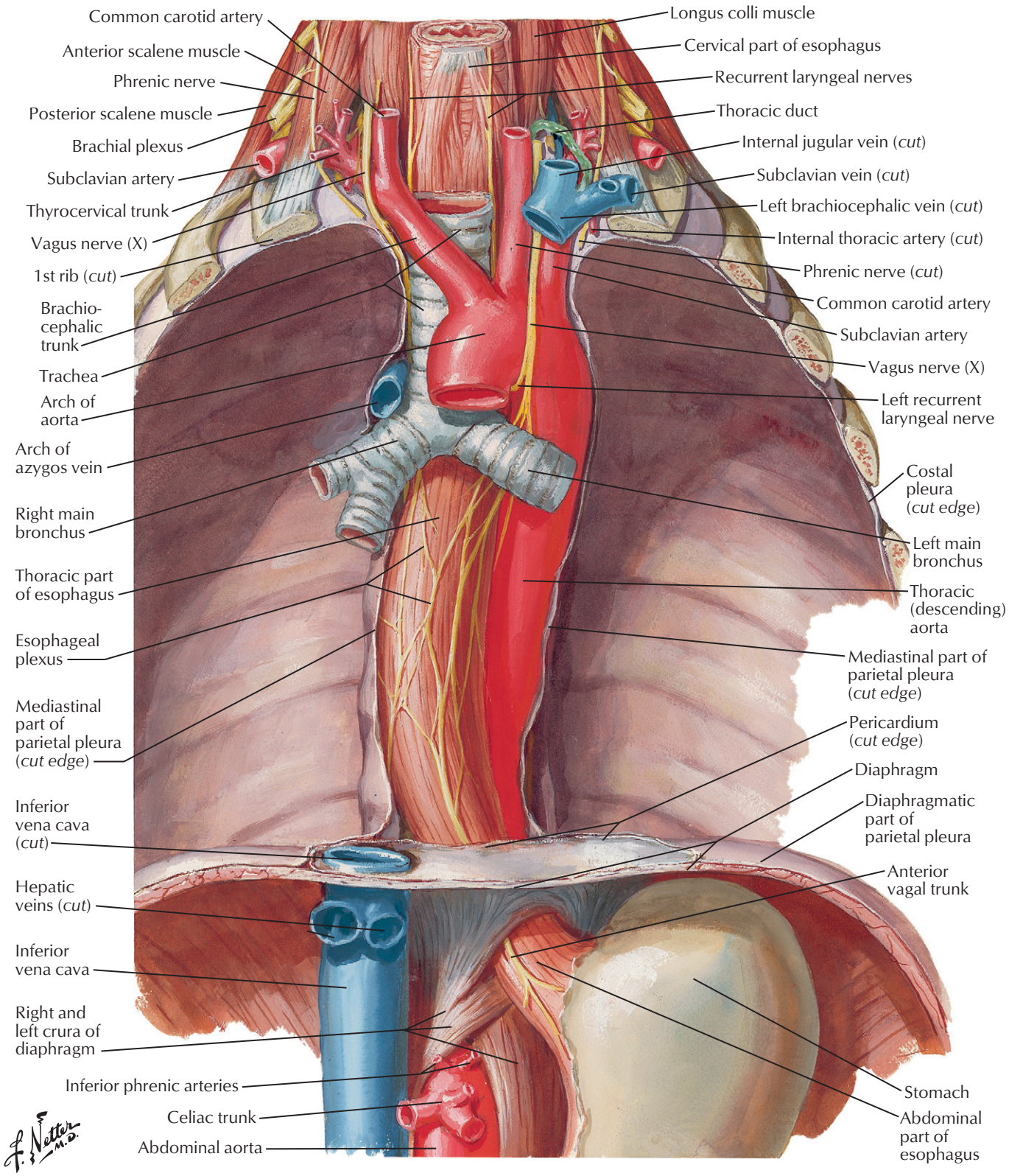


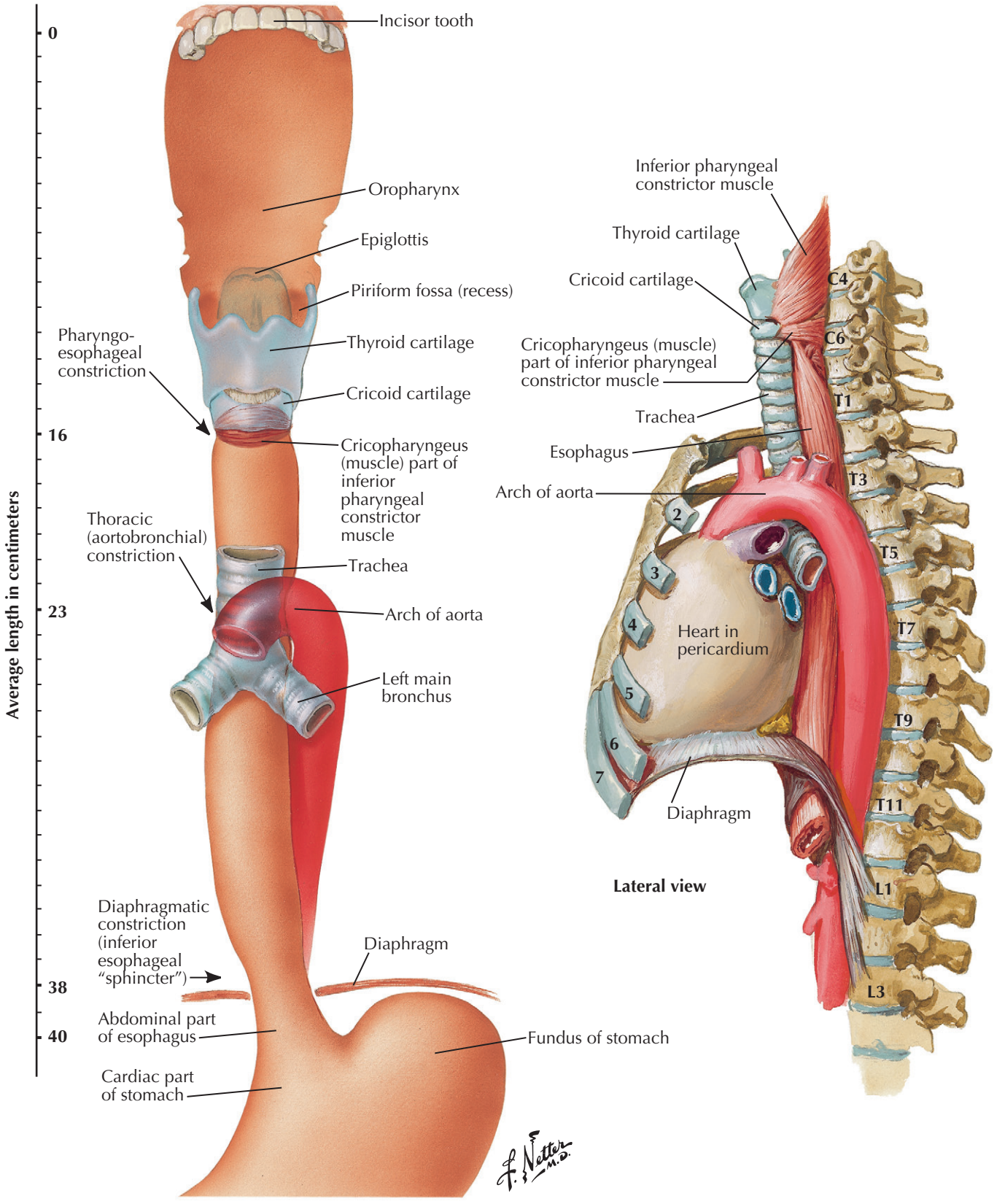
*Nerve and vessels commonly run independently.



*Nerve and vessels commonly run independently.

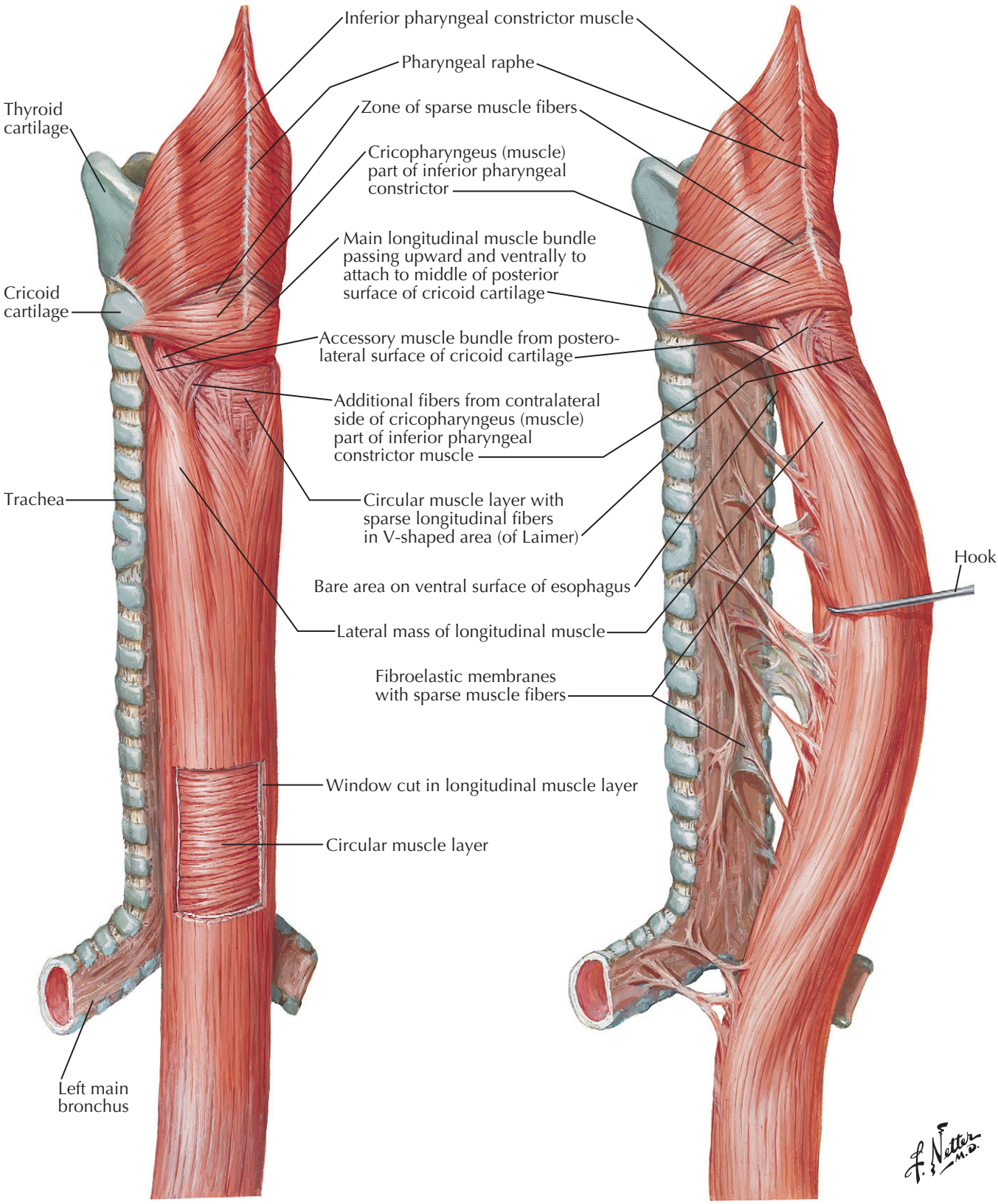
Esophagus in Situ



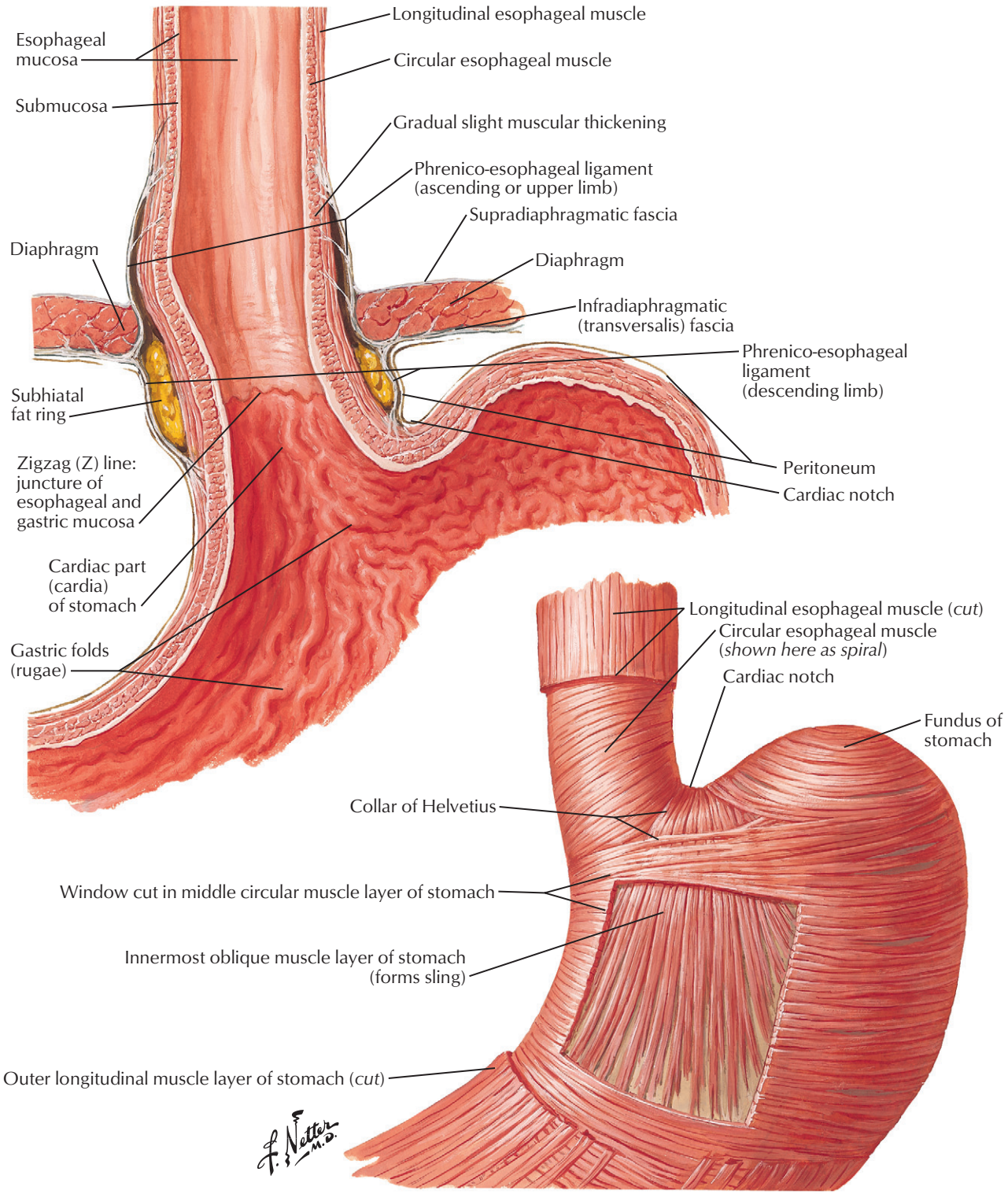

Average length in centimeters
0
16
23
38
40
Incisor tooth
Oropharynx
Epiglottis
Piriform fossa (recess)
Pharyngo-esophageal constriction
Thyroid cartilage
Cricoid cartilage
Cricopharyngeus (muscle) part of inferior pharyngeal constrictor muscle
Thoracic (aortobronchial) constriction
Trachea
Arch of aorta
Left main bronchus
Diaphragmatic constriction (inferior esophageal "sphincter")
Diaphragm
Abdominal part of esophagus
Fundus of stomach
Cardiac part of stomach
Inferior pharyngeal constrictor muscle
Thyroid cartilage
Cricoid cartilage
Cricopharyngeus (muscle) part of inferior pharyngeal constrictor muscle
Trachea
Esophagus
Arch of aorta
Heart in pericardium
Diaphragm
C4
C6
T1
T3
T5
T7
T9
T11
L1
L3
2
3
4
5
6
7
Lateral view

Musculature of Esophagus

See also Plates 67, 70

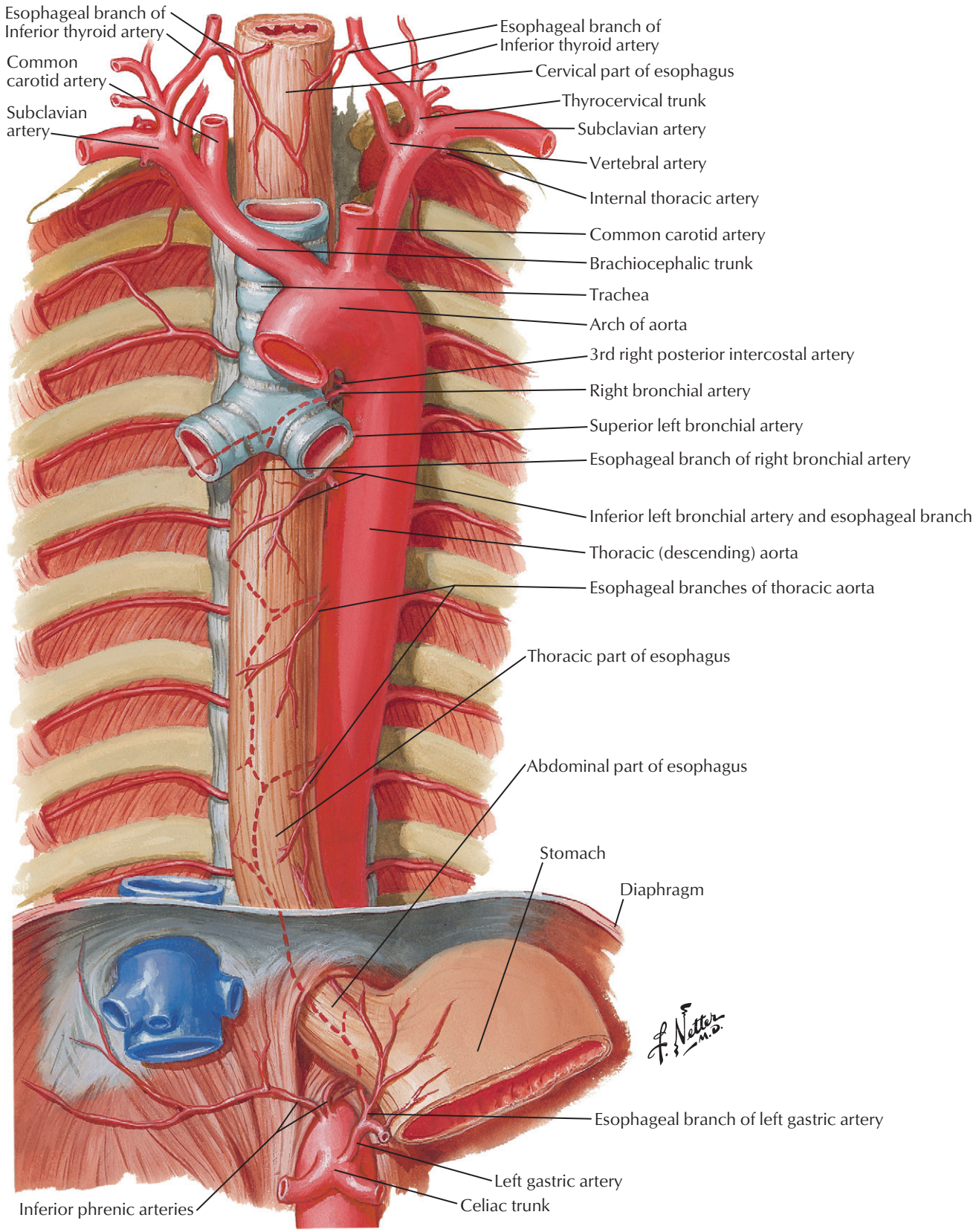


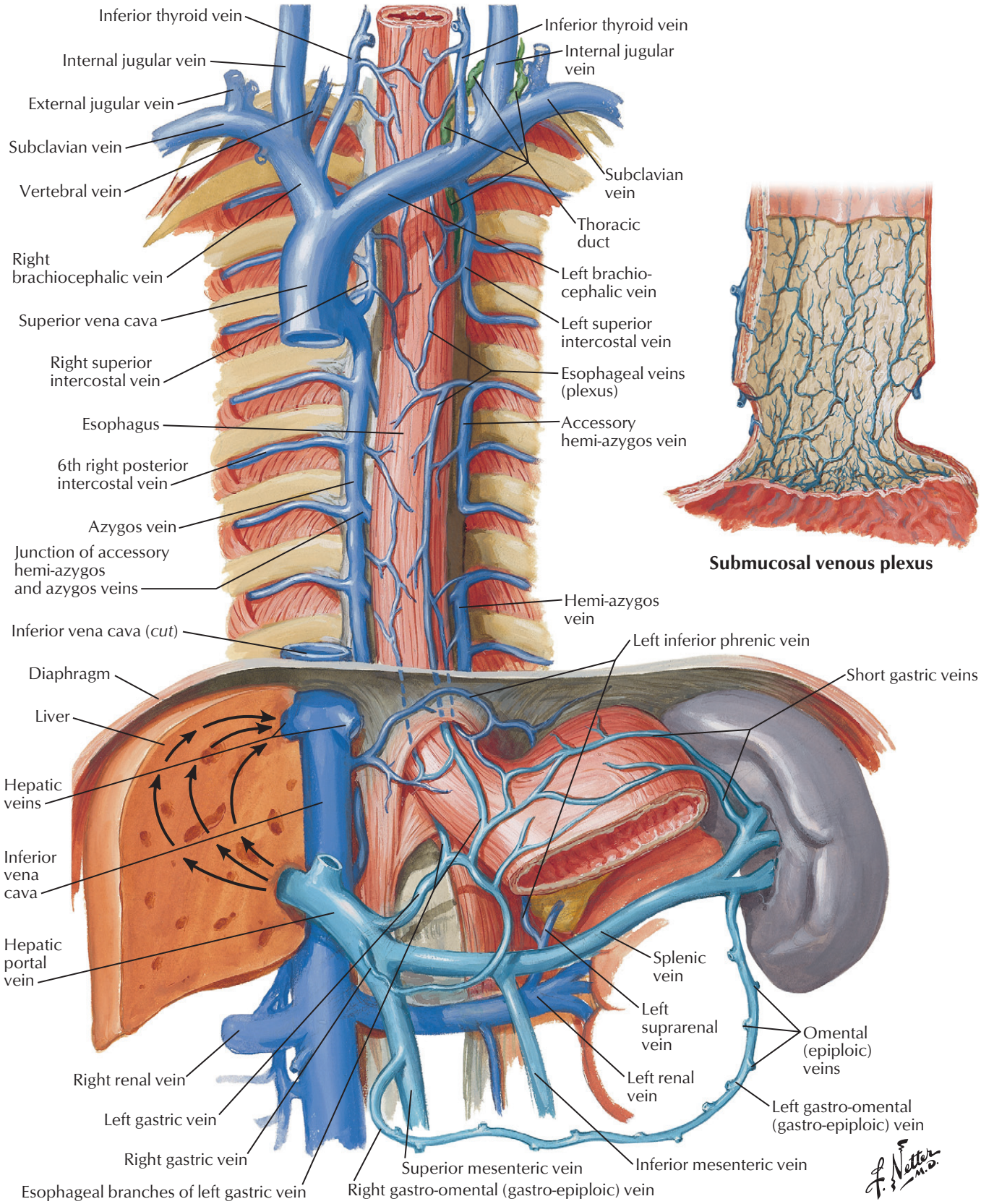
Posterolateral view


Esophageal mucosa
Submucosa
Diaphragm
Subhiatal fat ring
Zigzag (Z) line: juncture of esophageal and gastric mucosa
Cardiac part (cardia) of stomach
Gastric folds (rugae)
Longitudinal esophageal muscle
Circular esophageal muscle
Gradual slight muscular thickening
Phrenico-esophageal ligament (ascending or upper limb)
Supradiaphragmatic fascia
Diaphragm
Infradiaphragmatic (transversalis) fascia
Phrenico-esophageal ligament (descending limb)
Peritoneum
Cardiac notch
Longitudinal esophageal muscle (cut)
Circular esophageal muscle (shown here as spiral)
Cardiac notch
Fundus of stomach
Collar of Helvetius
Window cut in middle circular muscle layer of stomach
Innermost oblique muscle layer of stomach (forms sling)
Outer longitudinal muscle layer of stomach (cut)

Arteries of Esophagus

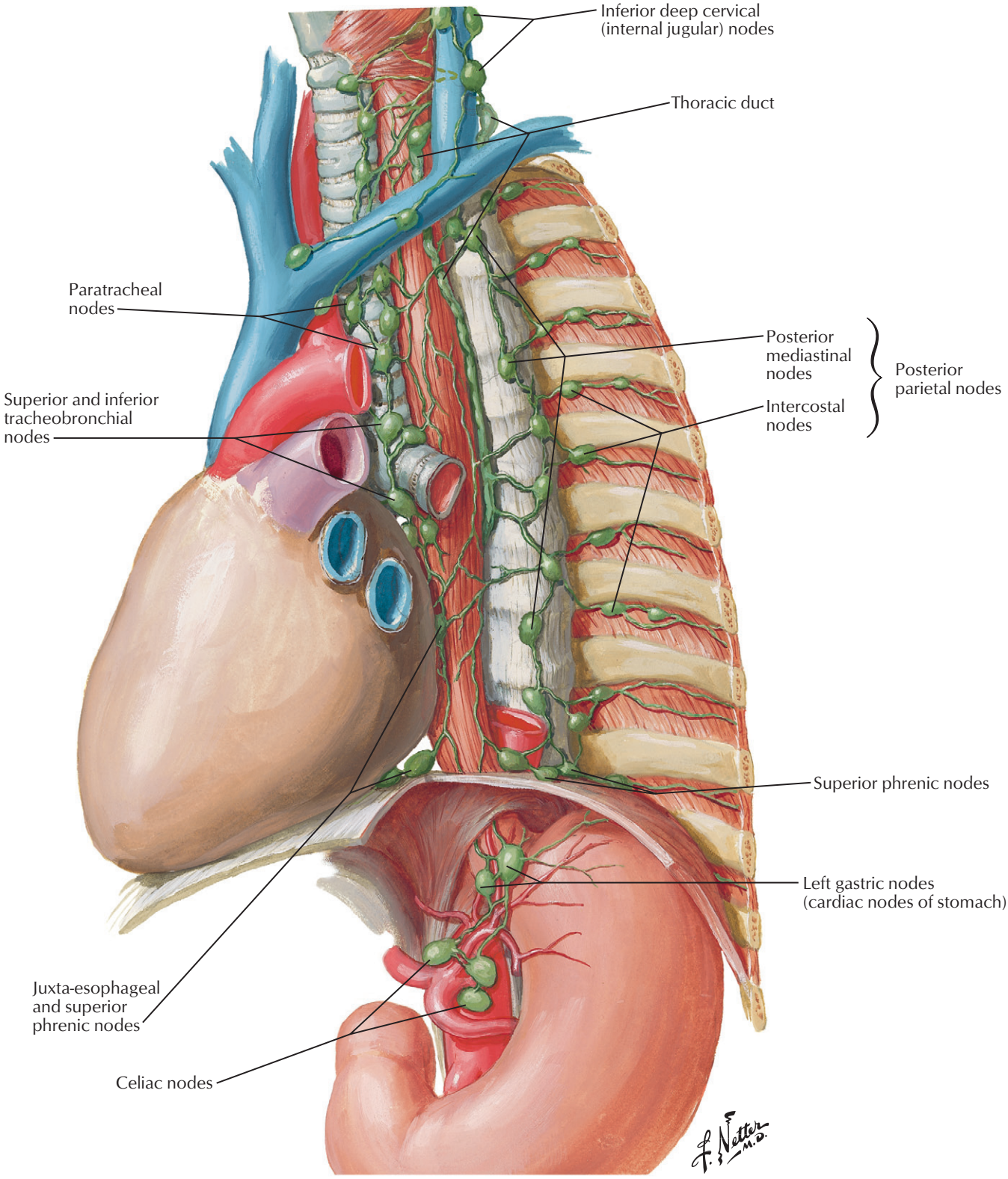
See also Plates 204, 284

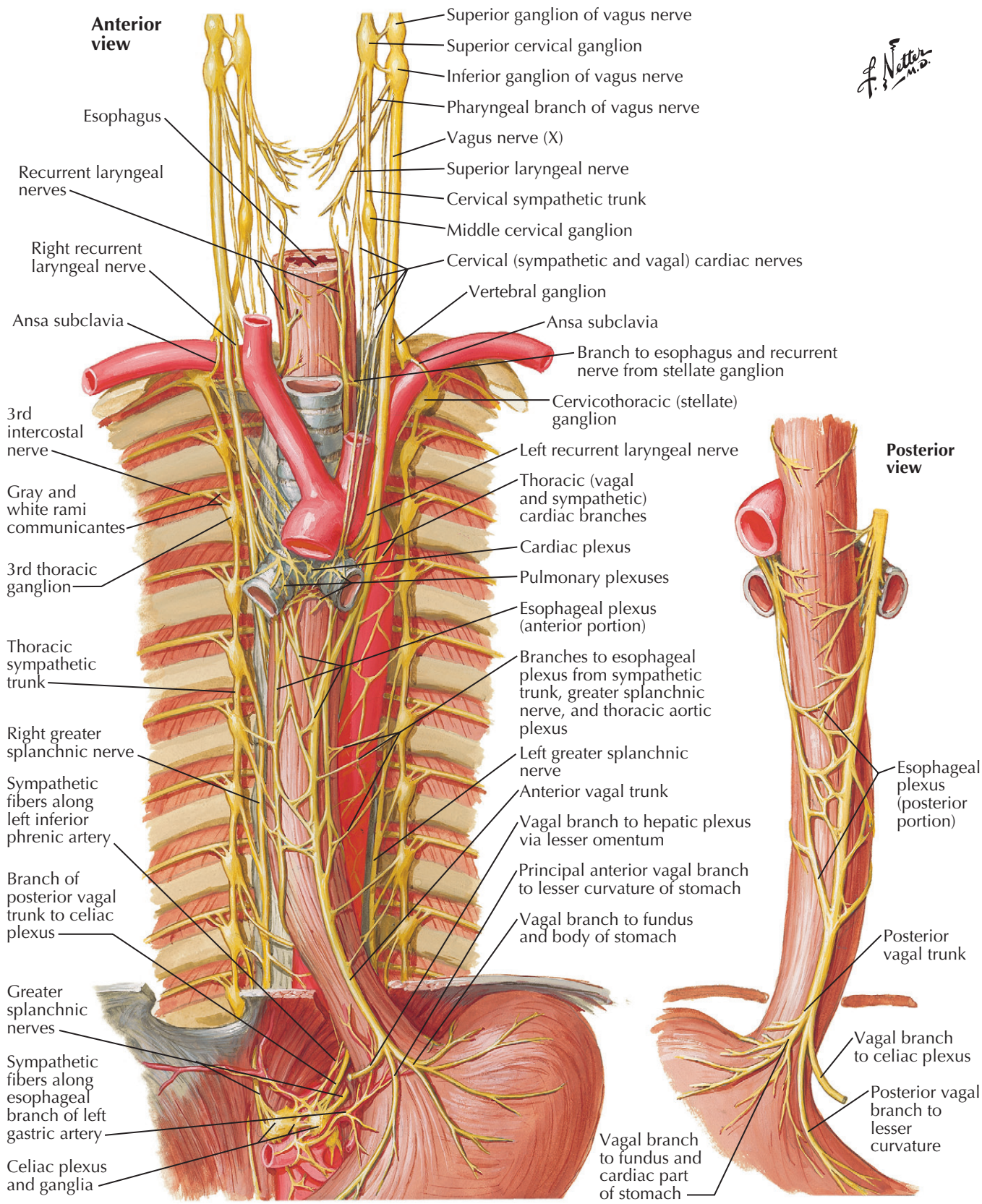



Inferior thyroid vein
Internal jugular vein
External jugular vein
Subclavian vein
Vertebral vein
Right brachiocephalic vein
Superior vena cava
Right superior intercostal vein
Esophagus
6th right posterior intercostal vein
Azygos vein
Junction of accessory hemi-azygos and azygos veins
Inferior vena cava (cut)
Diaphragm
Liver
Hepatic veins
Inferior vena cava
Hepatic portal vein
Right renal vein
Left gastric vein
Right gastric vein
Esophageal branches of left gastric vein
Inferior thyroid vein
Internal jugular vein
Subclavian vein
Thoracic duct
Left brachio-cephalic vein
Left superior intercostal vein
Esophageal veins (plexus)
Accessory hemi-azygos vein
Hemi-azygos vein
Left inferior phrenic vein
Short gastric veins
Splenic vein
Left suprarenal vein
Left renal vein
Omental (epiploic) veins
Left gastro-omental (gastro-epiploic) vein
Inferior mesenteric vein
Superior mesenteric vein
Right gastro-omental (gastro-epiploic) vein
Submucosal venous plexus

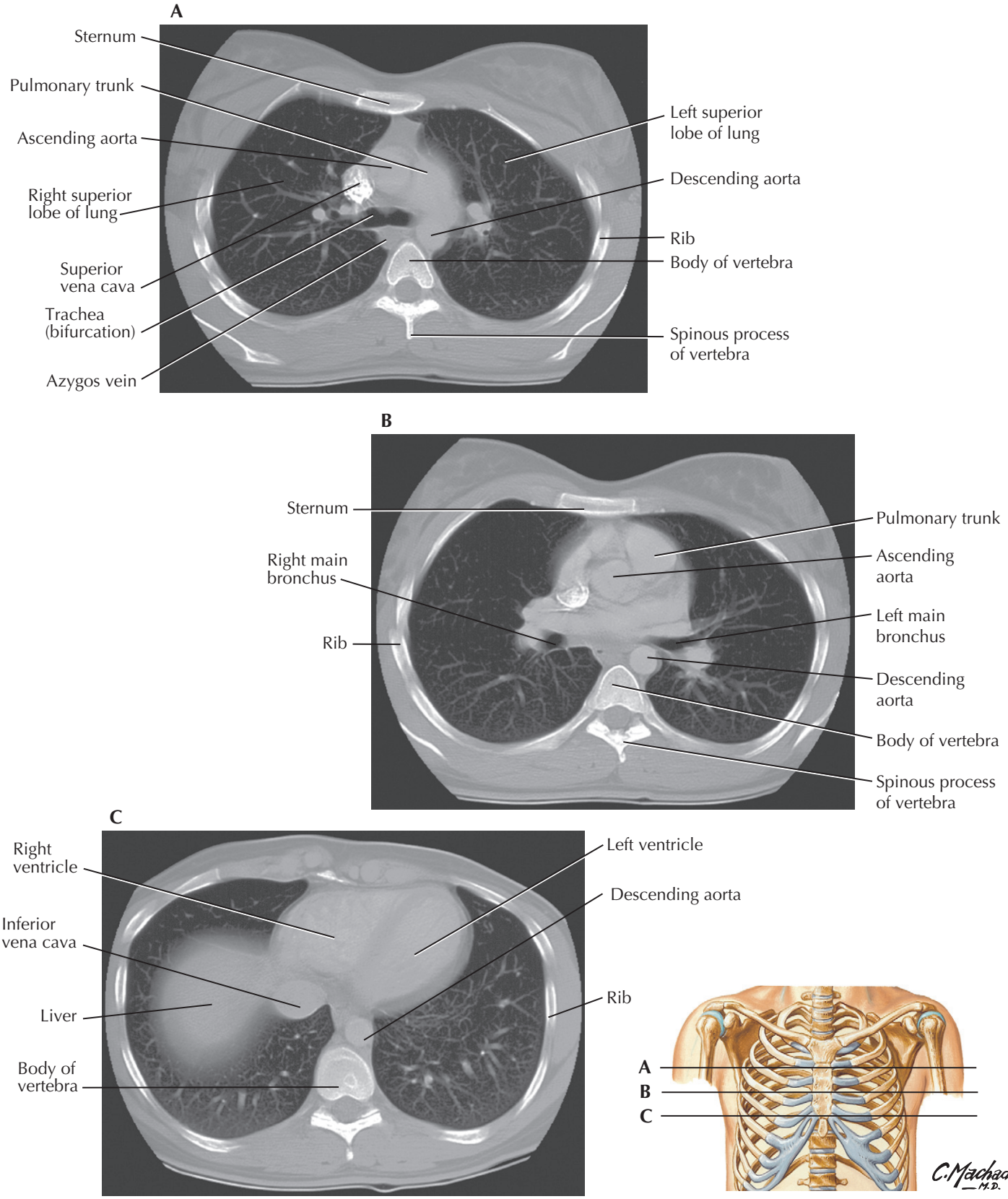
Lymph Vessels and Nodes of Esophagus

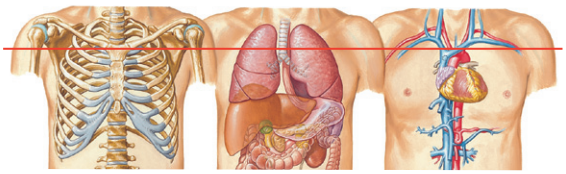
See also Plates 205, 293

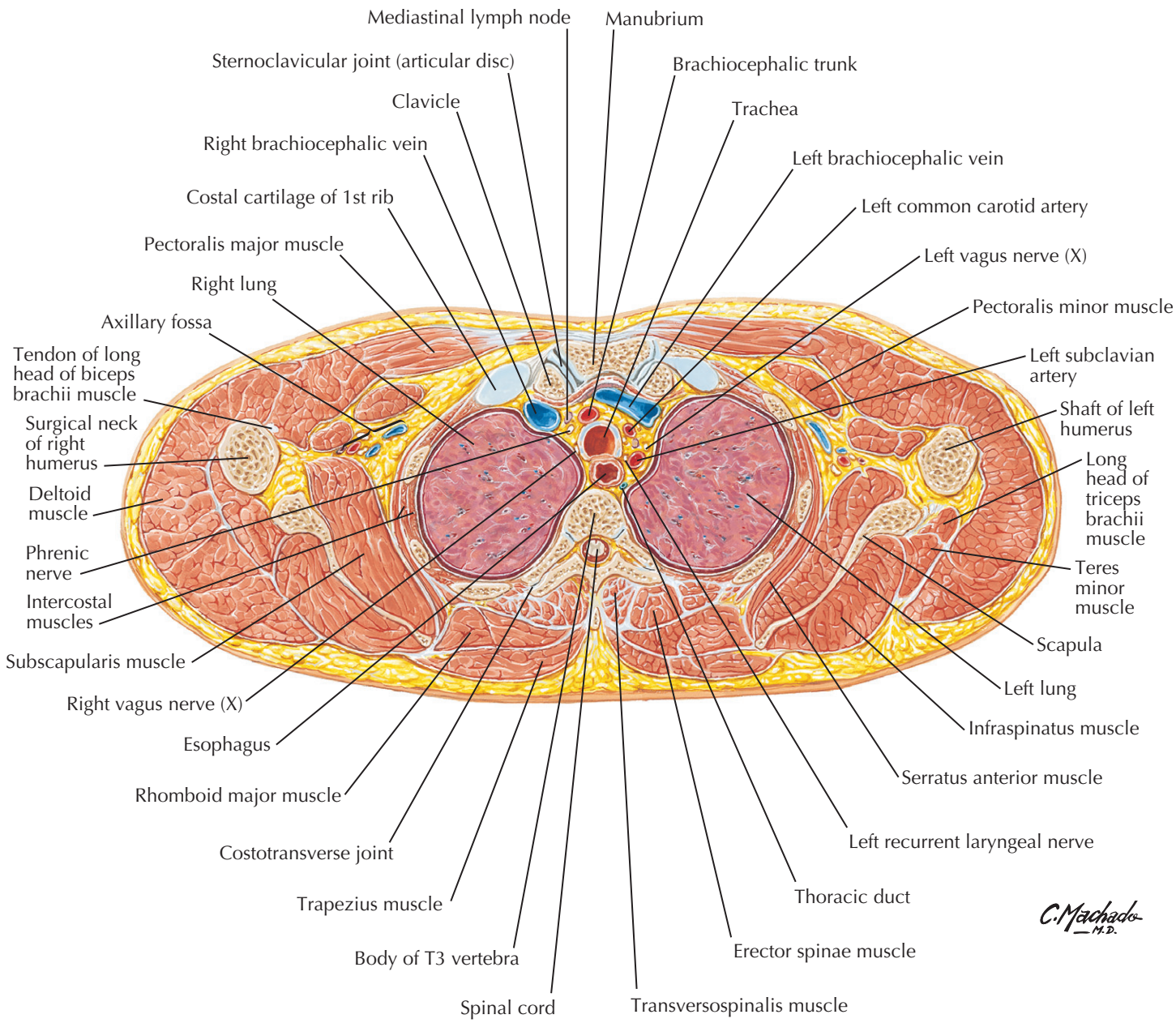



Anterior view
Superior ganglion of vagus nerve
Superior cervical ganglion
Inferior ganglion of vagus nerve
Pharyngeal branch of vagus nerve
Esophagus
Vagus nerve (X)
Recurrent laryngeal nerves
Superior laryngeal nerve
Cervical sympathetic trunk
Middle cervical ganglion
Right recurrent laryngeal nerve
Cervical (sympathetic and vagal) cardiac nerves
Vertebral ganglion
Ansa subclavia
Ansa subclavia
Branch to esophagus and recurrent nerve from stellate ganglion
Cervicothoracic (stellate) ganglion
3rd intercostal nerve
Left recurrent laryngeal nerve
Gray and white rami communicantes
Thoracic (vagal and sympathetic) cardiac branches
Cardiac plexus
3rd thoracic ganglion
Pulmonary plexuses
Esophageal plexus (anterior portion)
Thoracic sympathetic trunk
Branches to esophageal plexus from sympathetic trunk, greater splanchnic nerve, and thoracic aortic plexus
Right greater splanchnic nerve
Left greater splanchnic nerve
Sympathetic fibers along left inferior phrenic artery
Anterior vagal trunk
Vagal branch to hepatic plexus via lesser omentum
Branch of posterior vagal trunk to celiac plexus
Principal anterior vagal branch to lesser curvature of stomach
Vagal branch to fundus and body of stomach
Greater splanchnic nerves
Sympathetic fibers along esophageal branch of left gastric artery
Celiac plexus and ganglia
Vagal branch to fundus and cardiac part of stomach
Posterior view
Esophageal plexus (posterior portion)
Posterior vagal trunk
Vagal branch to celiac plexus
Posterior vagal branch to lesser curvature

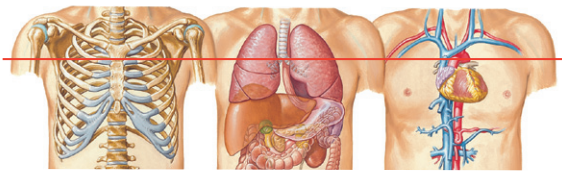
Series of chest axial CT images from superior (A) to inferior (C)

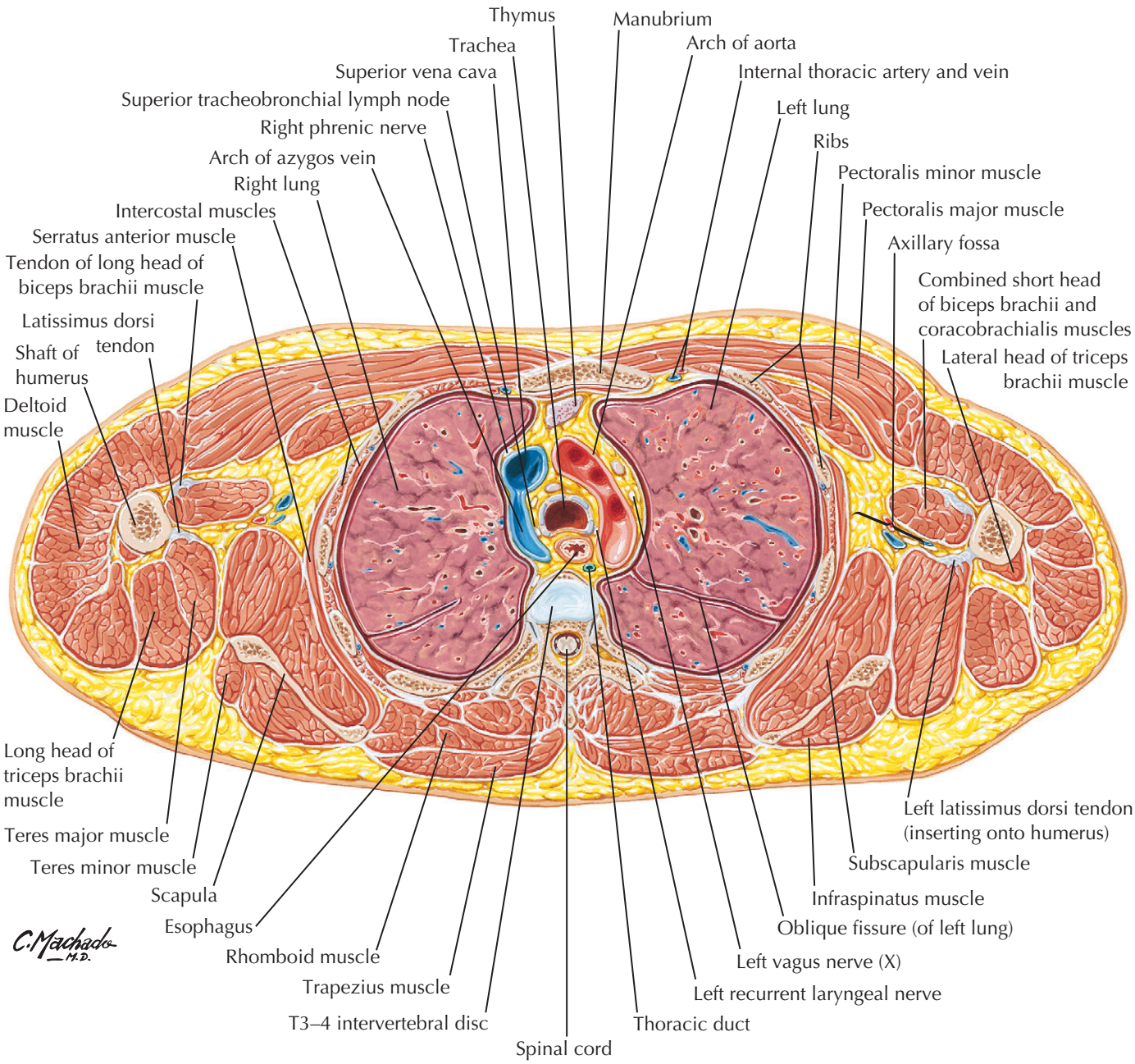




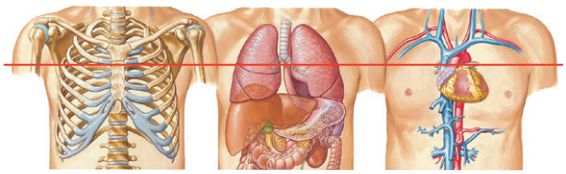

Mediastinal lymph node
Manubrium
Sternoclavicular joint (articular disc)
Brachiocephalic trunk
Clavicle
Trachea
Right brachiocephalic vein
Left brachiocephalic vein
Costal cartilage of 1st rib
Left common carotid artery
Pectoralis major muscle
Left vagus nerve (X)
Right lung
Pectoralis minor muscle
Axillary fossa
Tendon of long head of biceps brachii muscle
Left subclavian artery
Surgical neck of right humerus
Shaft of left humerus
Deltoid muscle
Long head of triceps brachii muscle
Phrenic nerve
Teres minor muscle
Intercostal muscles
Scapula
Subscapularis muscle
Left lung
Right vagus nerve (X)
Infraspinatus muscle
Esophagus
Serratus anterior muscle
Rhomboid major muscle
Left recurrent laryngeal nerve
Costotransverse joint
Thoracic duct
Trapezius muscle
Erector spinae muscle
Body of T3 vertebra
Spinal cord
Transversospinalis muscle
C. Machado M.D.

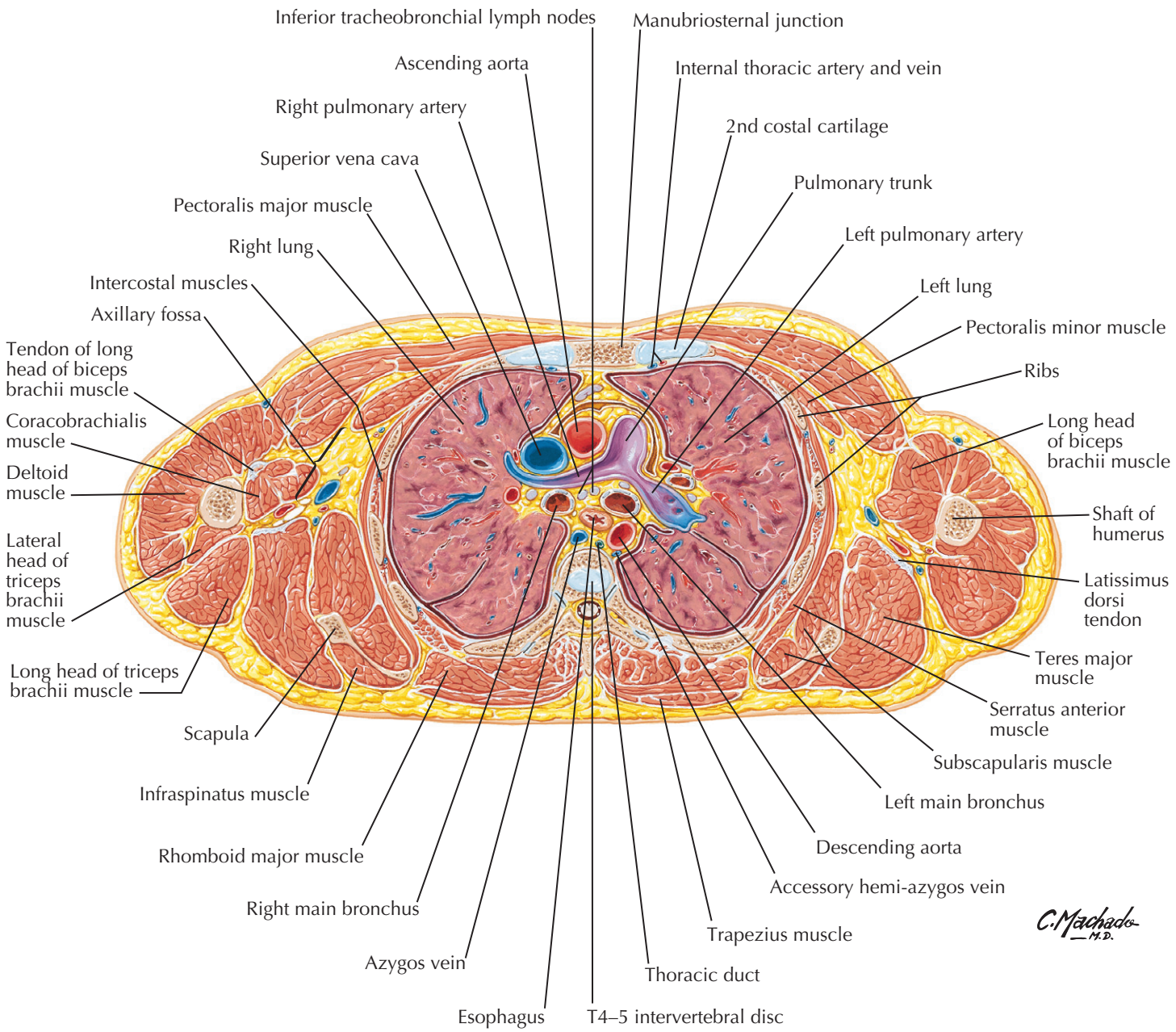
Cross Section of Thorax at T3-4 Disc Level



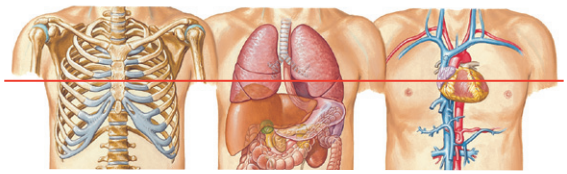


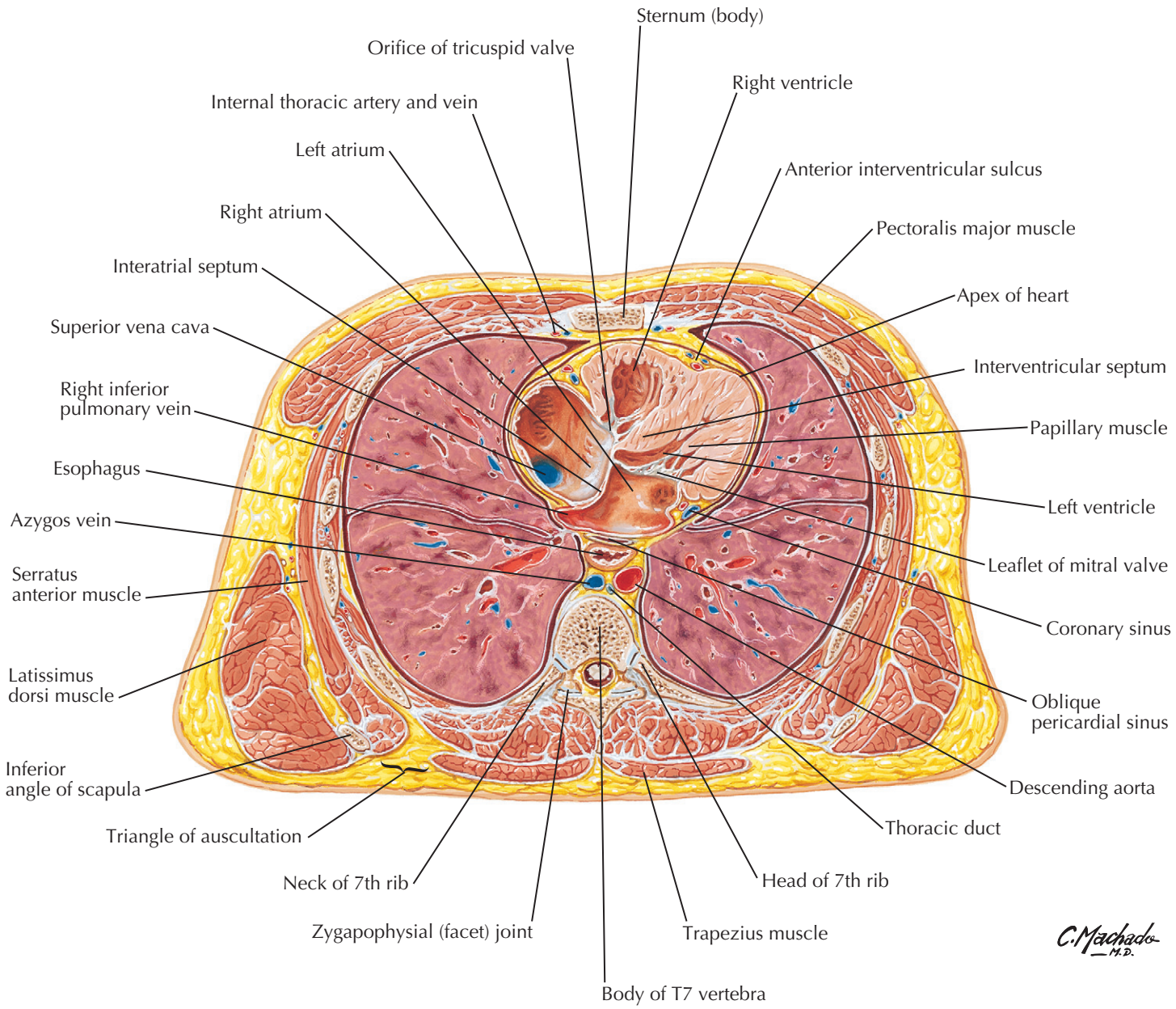
Cross Section of Thorax at T4-5 Disc Level





Cross Section of Thorax at T7 Level

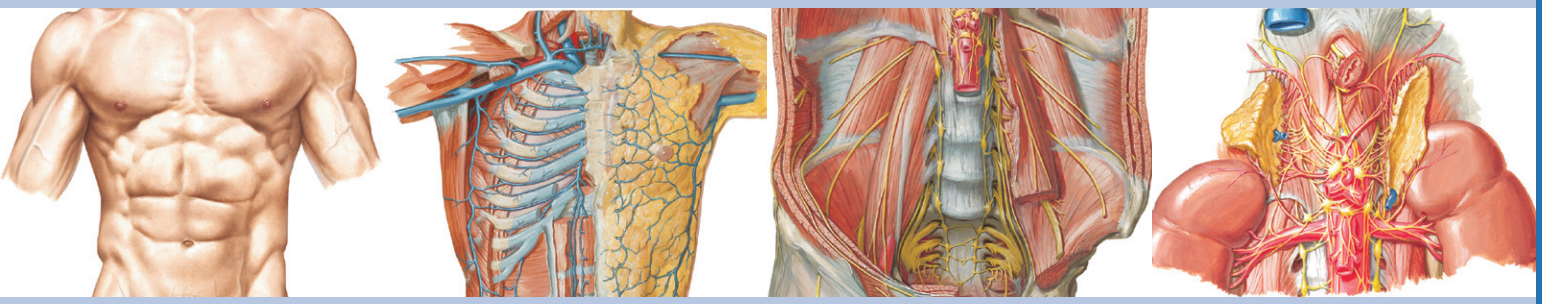




MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Diaphragm	Xiphoid process, lower six costal cartilages, L1–L3 vertebrae	Converge into central tendon	Phrenic nerve	Draws central tendon down and forward during inspiration	Pericardiacophrenic, musculophrenic, superior and inferior phrenic arteries	Posterior abdominal wall
External intercostal	Lower border of ribs	Upper border of rib below rib of origin	Intercostal nerves	Supports intercostal spaces in inspiration and expiration, elevates ribs in inspiration	Posterior intercostal arteries, collateral branches of posterior intercostal arteries, costocervical trunk, anterior intercostal branches of internal thoracic artery, musculophrenic artery	Thoracic wall
Innermost intercostal	Lower border of ribs	Upper border of rib below rib of origin	Intercostal nerves	Elevates ribs	Muscular branches of anterior intercostal arteries, muscular branches of posterior intercostal arteries, intercostal branches of internal thoracic and musculophrenic arteries, costocervical trunk branches	Thoracic wall
Internal intercostal	Lower border of ribs	Costal cartilage and edge of costal groove of rib above rib of origin	Intercostal nerves	Prevents pushing out or drawing in of intercostal spaces in inspiration and expiration, lowers ribs in forced expiration	Muscular branches of anterior intercostal arteries, muscular branches of posterior intercostal arteries, intercostal branches of internal thoracic and musculophrenic arteries, costocervical trunk branches	Thoracic wall
Levator costarum	Transverse processes of C7 and T1–T11	Subjacent ribs between tubercle and angle	Dorsal ramus of lower thoracic nerves	Elevates ribs	Posterior intercostal arteries	Thoracic wall
Pectoralis major	Sternal half of clavicle, sternum to 7th rib, cartilages of true ribs, aponeurosis of external oblique muscle	Lateral lip of intertubercular sulcus of humerus	Medial and lateral pectoral nerves	Flexes and adducts arm, rotates arm medially	Pectoral branch of thoraco-acromial artery, perforating branches of internal thoracic artery	Pectoral/axilla region
Pectoralis minor	Outer surface of upper margin of ribs 3–5	Coracoid process of scapula	Medial pectoral nerve	Lowers lateral angle of scapula and protracts scapula	Pectoral branch of thoraco-acromial and intercostal lateral thoracic arteries	Pectoral/axilla region
Serratus anterior	Lateral surfaces of upper 8–9 ribs	Costal surface of medial border of scapula	Long thoracic nerve	Protracts scapula and holds it against thoracic wall	Lateral thoracic artery	Pectoral/axilla region
Serratus posterior inferior	Spinous processes of T11–L2	Inferior aspect of ribs 9–12	Ventral rami of lower thoracic nerves	Depresses ribs	Posterior intercostal arteries	Superficial back
Serratus posterior superior	Ligamentum nuchae, spinous processes of C7–T3	Superior aspect of ribs 2–4	Ventral rami of upper thoracic nerves	Elevates ribs	Posterior intercostal arteries	Superficial back
Subcostal	Internal surface of lower ribs near their angles	Superior borders of 2nd or 3rd rib below	Intercostal nerves	Depresses ribs	Posterior intercostal artery, musculophrenic artery	Thoracic wall
Transversus thoracis	Internal surface of costal cartilages 2–6	Posterior surface of lower sternum	Intercostal nerves	Depresses ribs and costal cartilages	Anterior intercostal arteries, internal thoracic artery	Thoracic wall

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

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Section

4 ABDOMEN

Topographic Anatomy

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Body Wall

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265 Mesenteric Relations of Intestines (continued)

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274 Ileocecal Region (continued)

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280 Gallbladder, Extrahepatic Bile Ducts, and Pancreatic Duct

281 Pancreas in Situ

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283 Arteries of Stomach, Liver, and Spleen

284 Arteries of Liver, Pancreas, Duodenum, and Spleen

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286 Arteries of Duodenum and Head of Pancreas

287 Arteries of Small Intestine

288 Arteries of Large Intestine

289 Veins of Stomach, Duodenum, Pancreas, and Spleen

290 Veins of Small Intestine

291 Veins of Large Intestine

292 Hepatic Portal Vein Tributaries: Portacaval Anastomoses

293 Lymph Vessels and Nodes of Stomach

294 Lymph Vessels and Nodes of Pancreas

295 Lymph Vessels and Nodes of Small Intestine

296 Lymph Vessels and Nodes of Large Intestine

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297 Autonomic Nerves and Ganglia of Abdomen

298 Autonomic Innervation of Stomach and Duodenum

299 Autonomic Innervation of Stomach and Duodenum (continued)

300 Autonomic Innervation of Stomach and Duodenum: Schema

301 Autonomic Innervation of Small Intestine

302 Autonomic Innervation of Large Intestine

303 Autonomic Innervation of Small and Large Intestines: Schema

304 Autonomic Reflex Pathways: Schema

305 Intrinsic Autonomic Plexuses of Intestine: Schema

306 Autonomic Innervation of Liver and Biliary Tract: Schema

307 Autonomic Innervation of Pancreas: Schema

Kidneys and Suprarenal Glands

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310 Renal Artery and Vein in Situ

311 Gross Structure of Kidney

312 Intrarenal Arteries and Renal Segments

313 Ureters in Abdomen and Pelvis

314 Arteries of Ureters and Urinary Bladder

315 Renal Fasciae

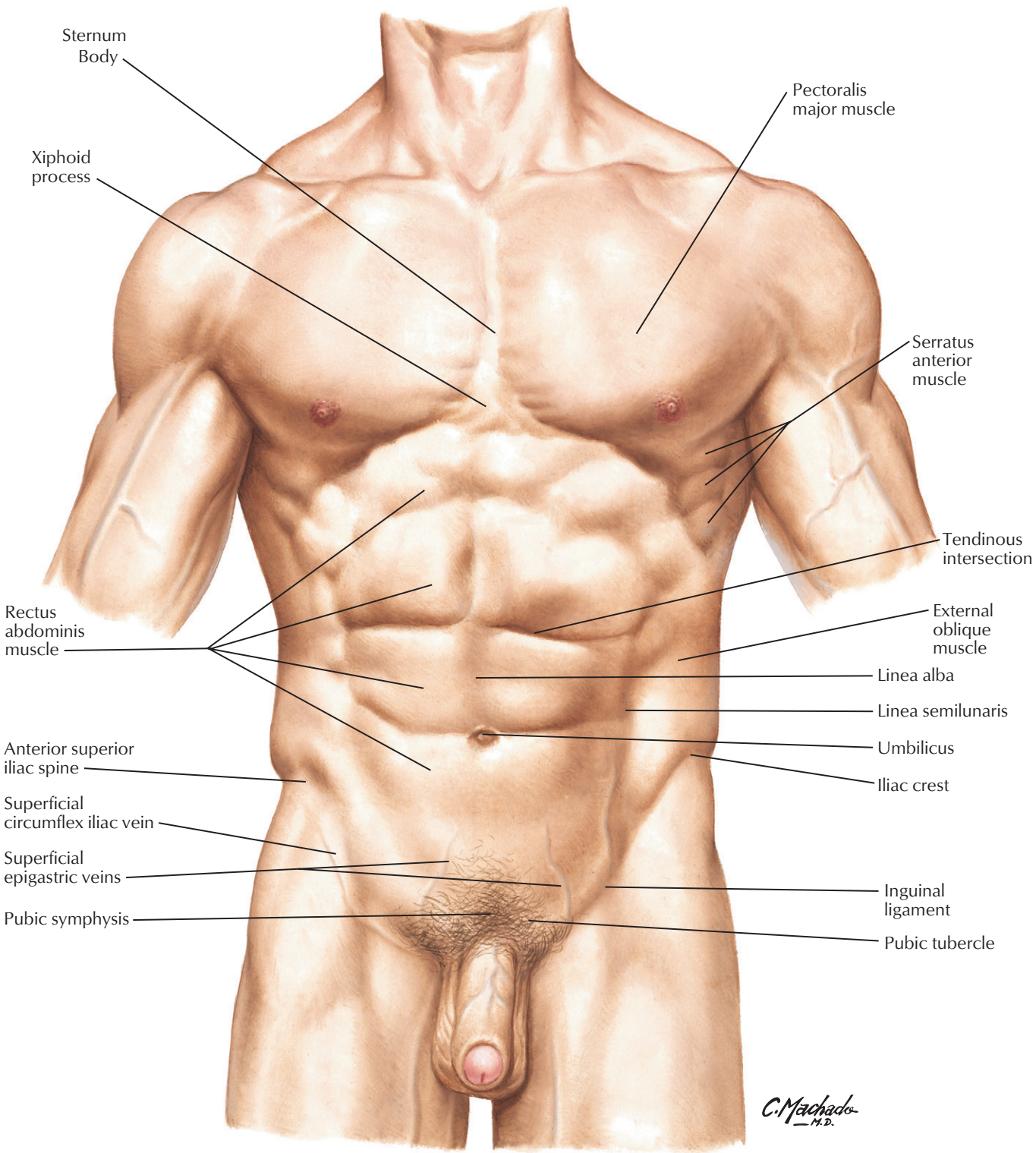
316 Lymph Vessels and Nodes of Kidneys and Urinary Bladder
317 Autonomic Nerves of Kidneys, Ureters, and Urinary Bladder
318 Autonomic Innervation of Kidneys and Upper Ureters: Schema
319 Autonomic Nerves of Suprarenal Glands: Dissection and Schema
320 Arteries and Veins of Suprarenal Glands in Situ

Sectional Anatomy

Plates 321–328

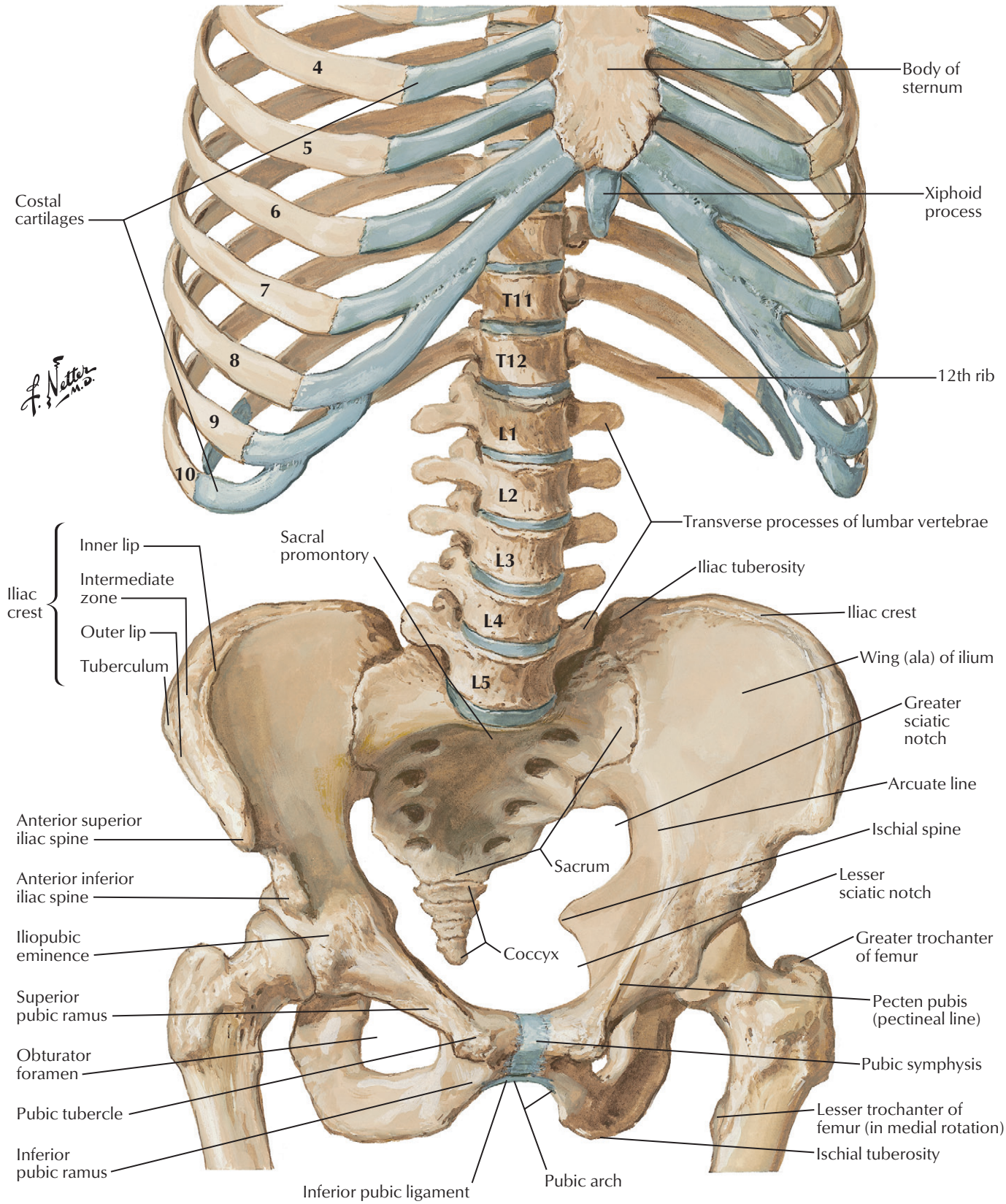
321 Abdominal Wall and Viscera: Paramedian (Parasagittal) Section
322 Abdominal Scans: Axial CT Images
323 Abdominal Scans: Axial CT Images (continued)
324 Cross Section at T10, Esophagogastric Junction
325 Cross Section at T12, Inferior to Xiphoid
326 Cross Section at T12–L1, Intervertebral Disc
327 Cross Section at L1–2, Intervertebral Disc
328 Cross Section at L3–4

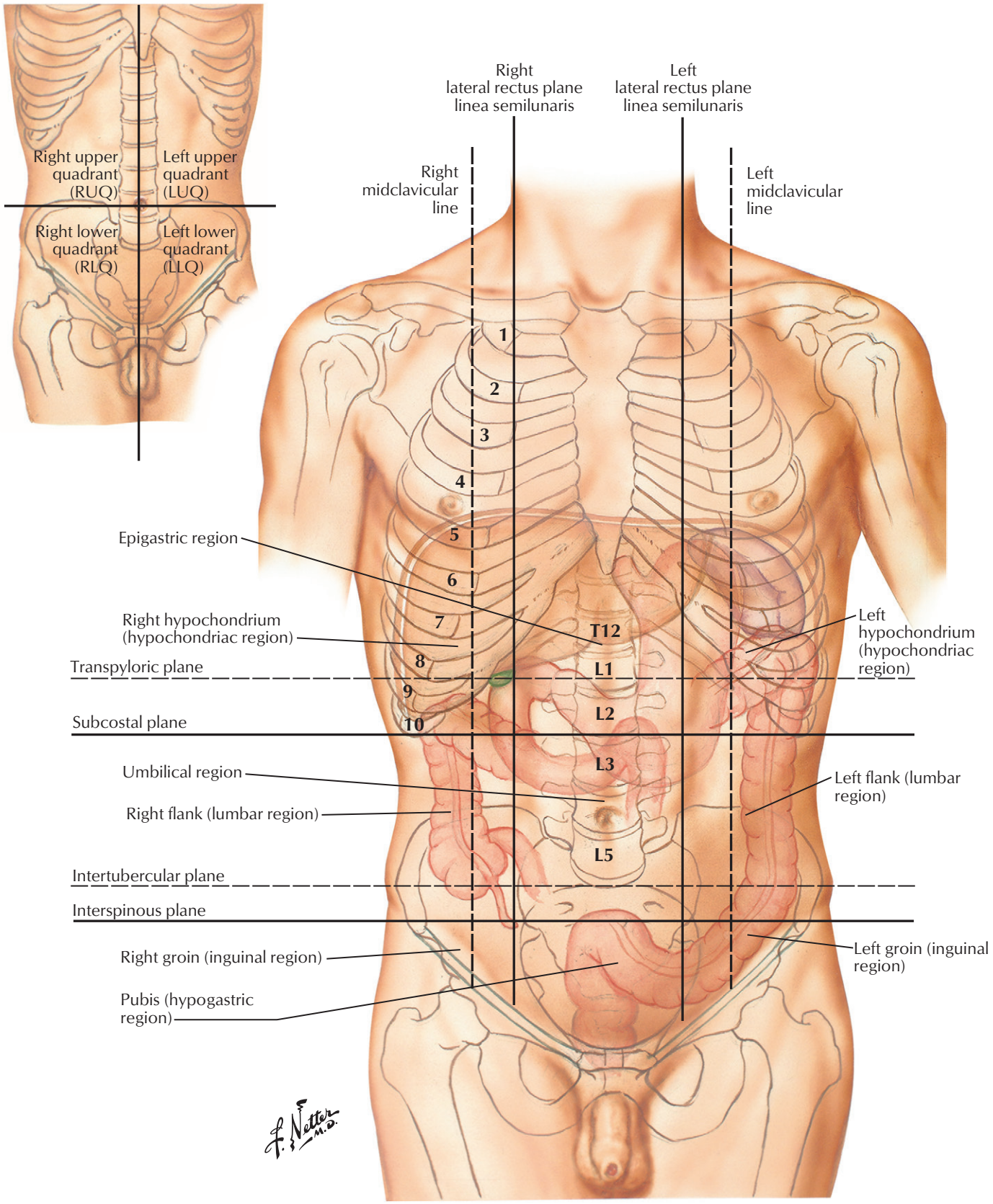
Muscle Table


Sternum
Body
Xiphoid
process
Pectoralis
major muscle
Serratus
anterior
muscle
Tendinous
intersection
Rectus
abdominis
muscle
External
oblique
muscle
Linea alba
Linea semilunaris
Umbilicus
Iliac crest
Anterior superior
iliac spine
Superficial
circumflex iliac vein
Superficial
epigastric veins
Pubic symphysis
Inguinal
ligament
Pubic tubercle
C. Machado M.D.

Bony Framework of Abdomen

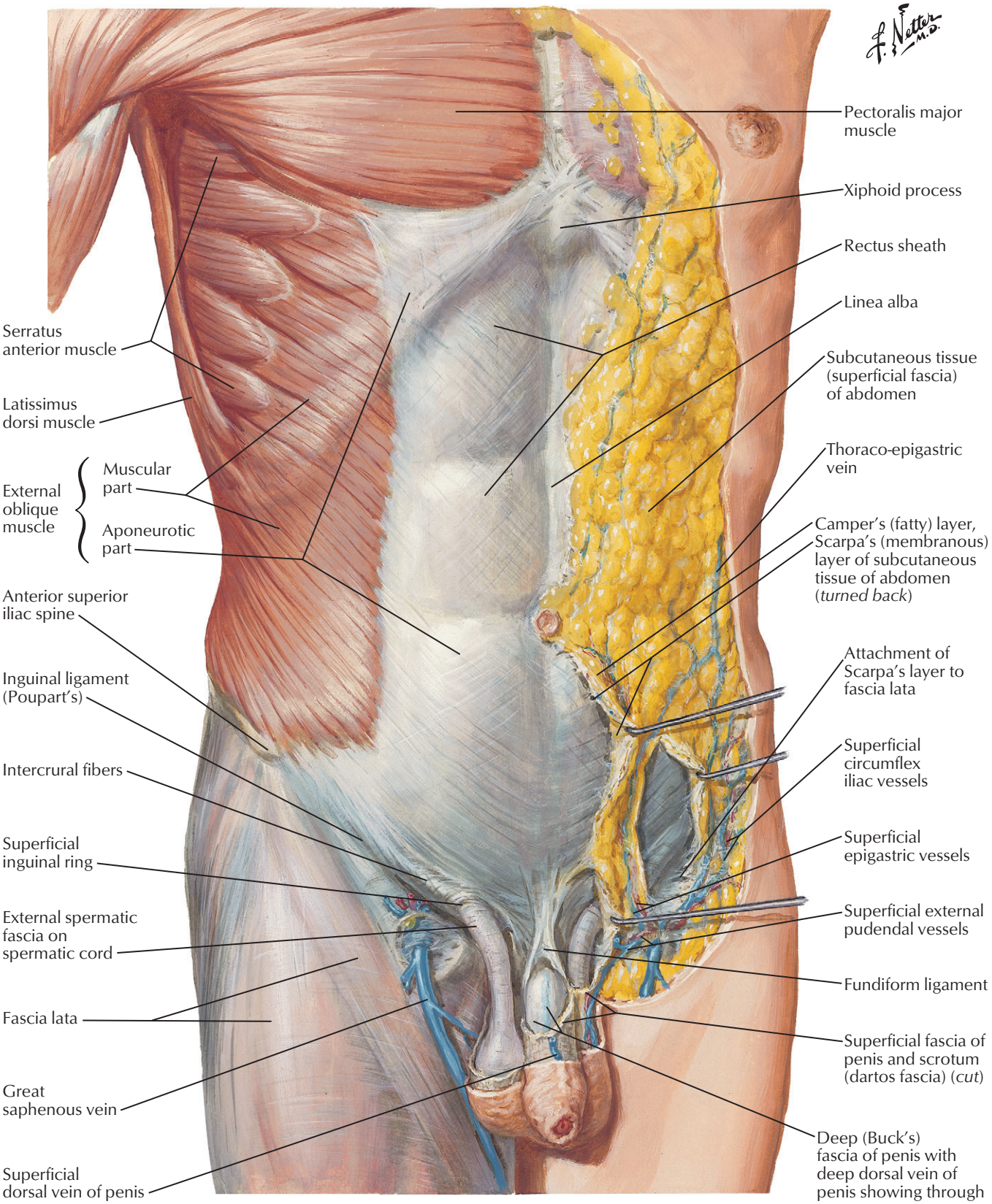
See also Plates 183, 332

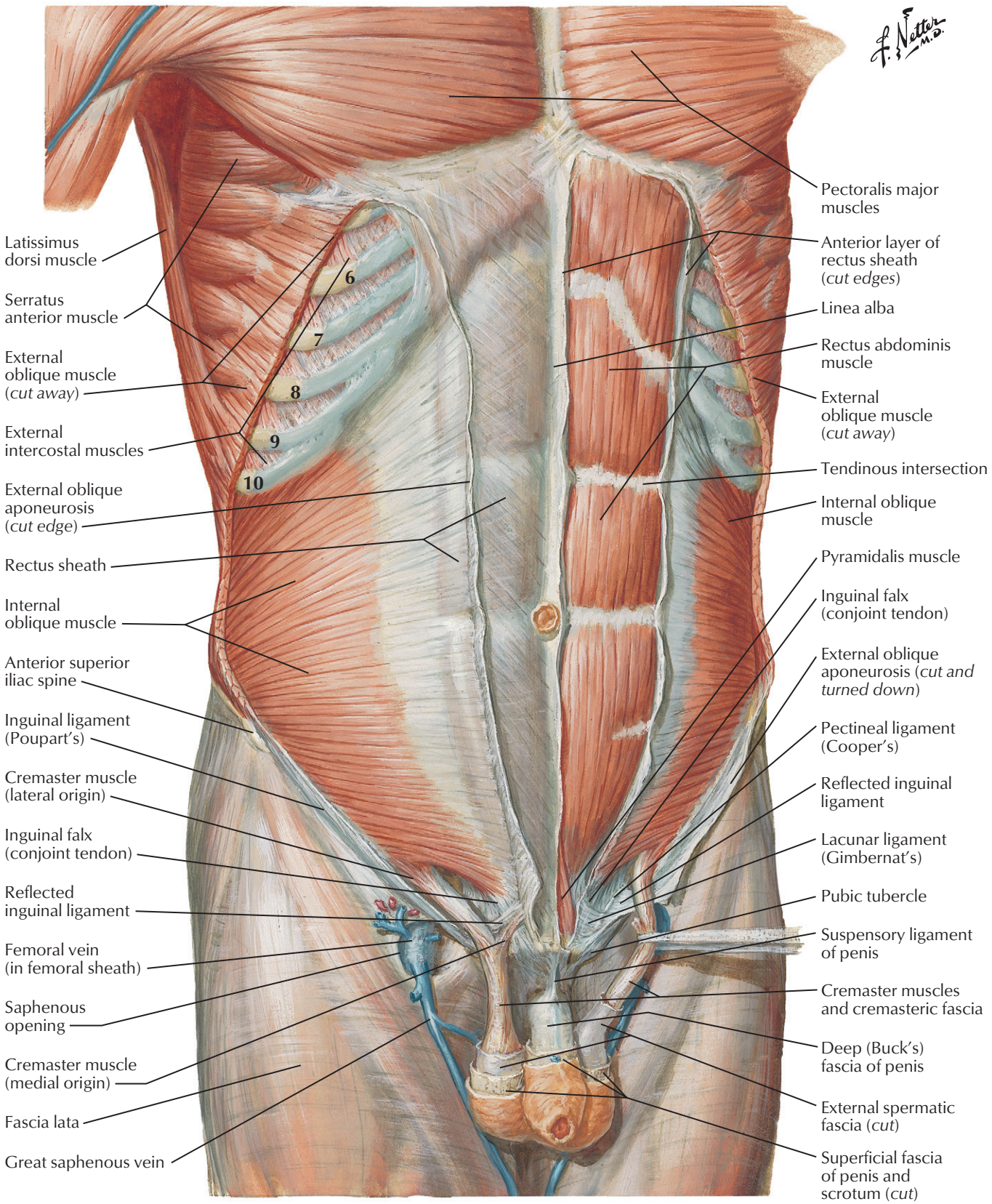



Right upper quadrant (RUQ)
Left upper quadrant (LUQ)
Right lower quadrant (RLQ)
Left lower quadrant (LLQ)
Right lateral rectus plane linea semilunaris
Left lateral rectus plane linea semilunaris
Right midclavicular line
Left midclavicular line
1
2
3
4
5
6
7
8
9
10
T12
L1
L2
L3
L5
Epigastric region
Right hypochondrium (hypochondriac region)
Left hypochondrium (hypochondriac region)
Transpyloric plane
Subcostal plane
Umbilical region
Right flank (lumbar region)
Left flank (lumbar region)
Intertubercular plane
Interspinous plane
Right groin (inguinal region)
Left groin (inguinal region)
Pubis (hypogastric region)
F. Netter M.D.

Anterior Abdominal Wall: Superficial Dissection

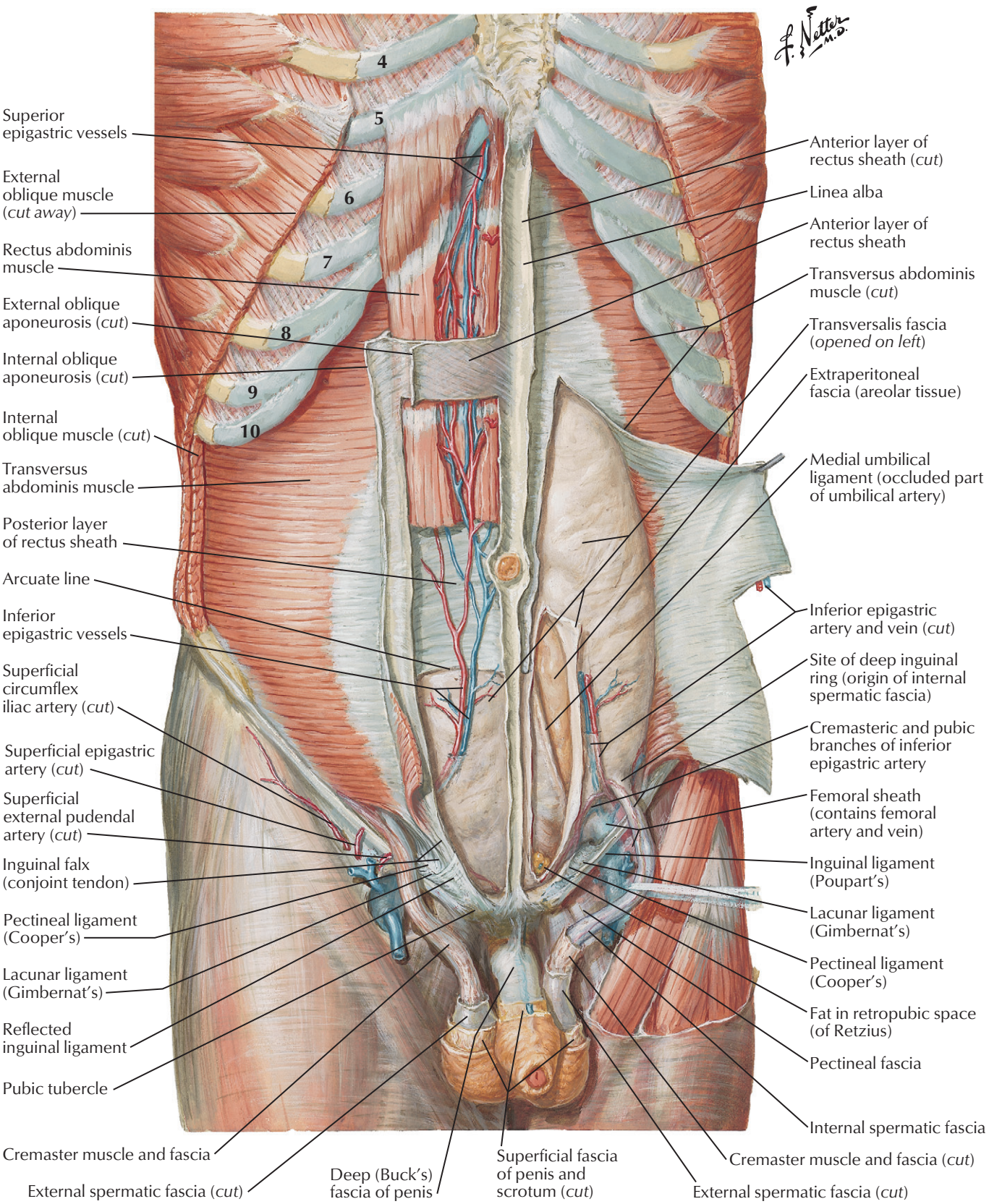
See also Plates 252, 329



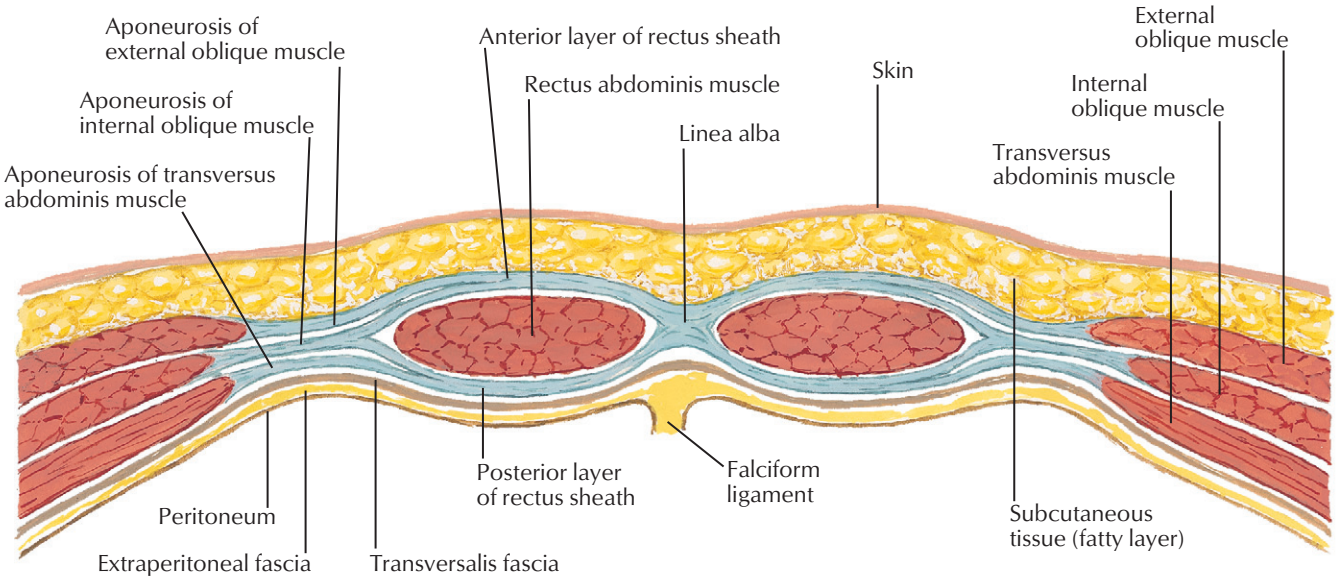

Latissimus dorsi muscle
Serratus anterior muscle
External oblique muscle (*cut away*)
External intercostal muscles
External oblique aponeurosis (*cut edge*)
Rectus sheath
Internal oblique muscle
Anterior superior iliac spine
Inguinal ligament (Poupart's)
Cremaster muscle (lateral origin)
Inguinal falx (conjoint tendon)
Reflected inguinal ligament
Femoral vein (in femoral sheath)
Saphenous opening
Cremaster muscle (medial origin)
Fascia lata
Great saphenous vein
6
7
8
9
10
Pectoralis major muscles
Anterior layer of rectus sheath (*cut edges*)
Linea alba
Rectus abdominis muscle
External oblique muscle (*cut away*)
Tendinous intersection
Internal oblique muscle
Pyramidalis muscle
Inguinal falx (conjoint tendon)
External oblique aponeurosis (*cut and turned down*)
Pectineal ligament (Cooper's)
Reflected inguinal ligament
Lacunar ligament (Gimbernat's)
Pubic tubercle
Suspensory ligament of penis
Cremaster muscles and cremasteric fascia
Deep (Buck's) fascia of penis
External spermatic fascia (*cut*)
Superficial fascia of penis and scrotum (*cut*)

Anterior Abdominal Wall: Deep Dissection

See also Plates 186, 251

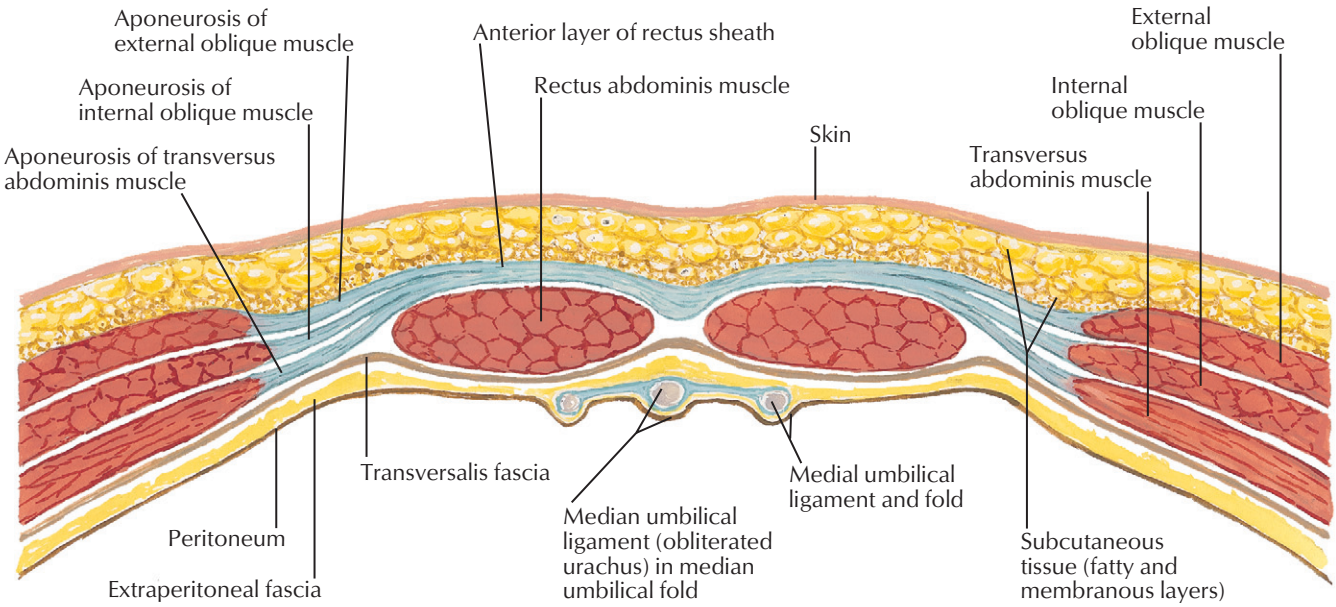


Section above arcuate line



Aponeurosis of internal oblique muscle splits to form anterior and posterior layers of rectus sheath. Aponeurosis of external oblique muscle joins anterior layer of sheath; aponeurosis of transversus abdominis muscle joins posterior layer. Anterior and posterior layers of rectus sheath unite medially to form linea alba.

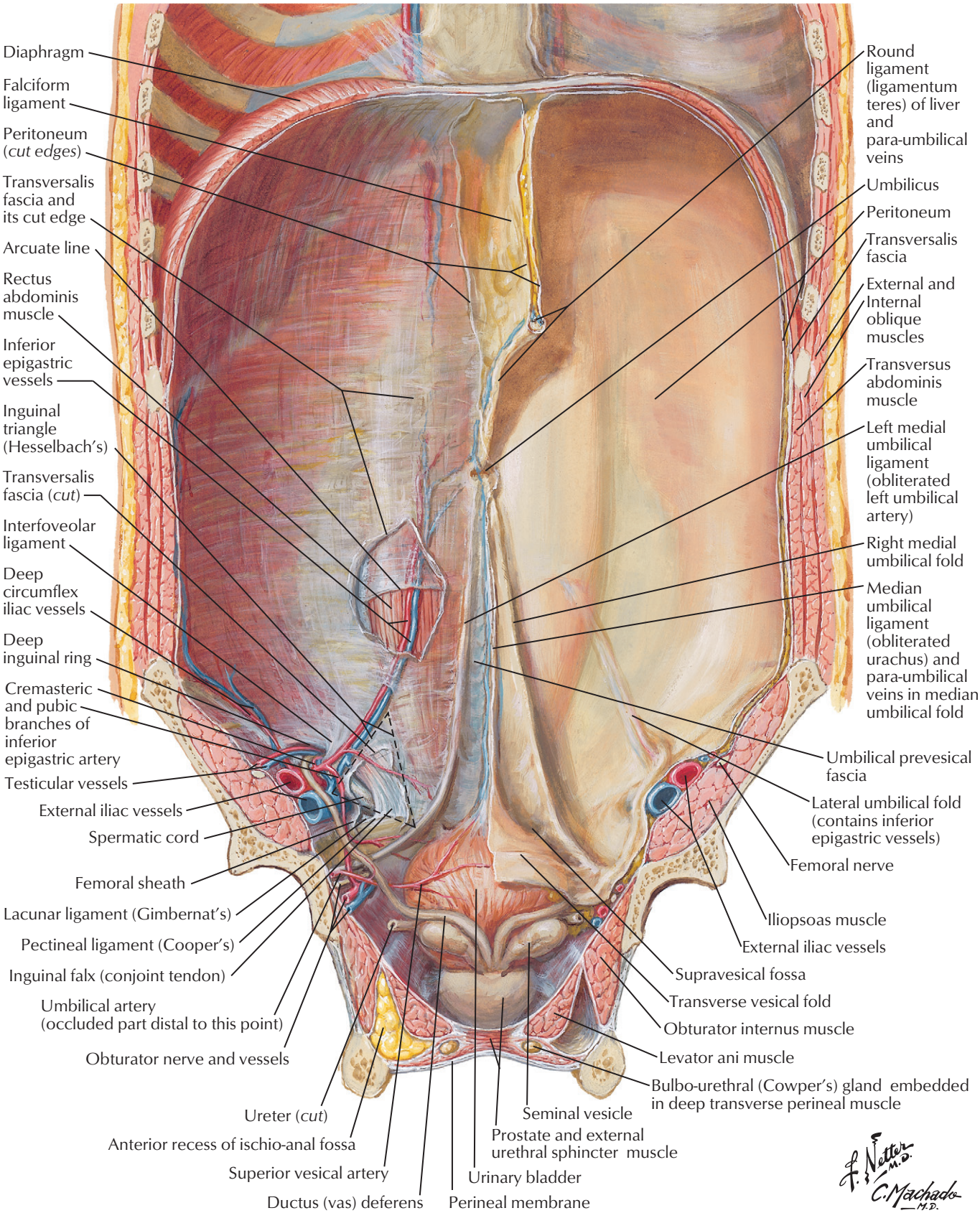
Section below arcuate line

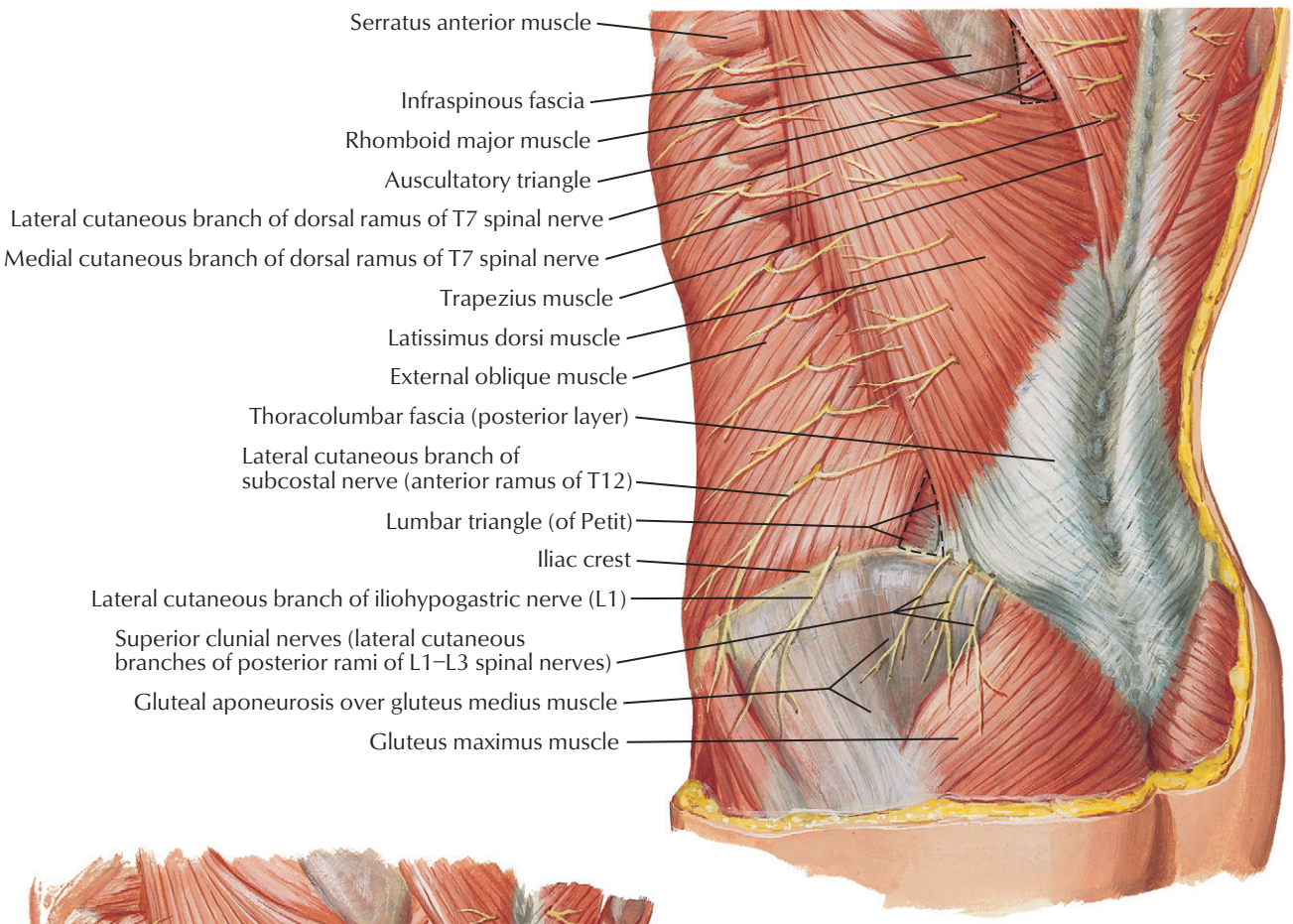


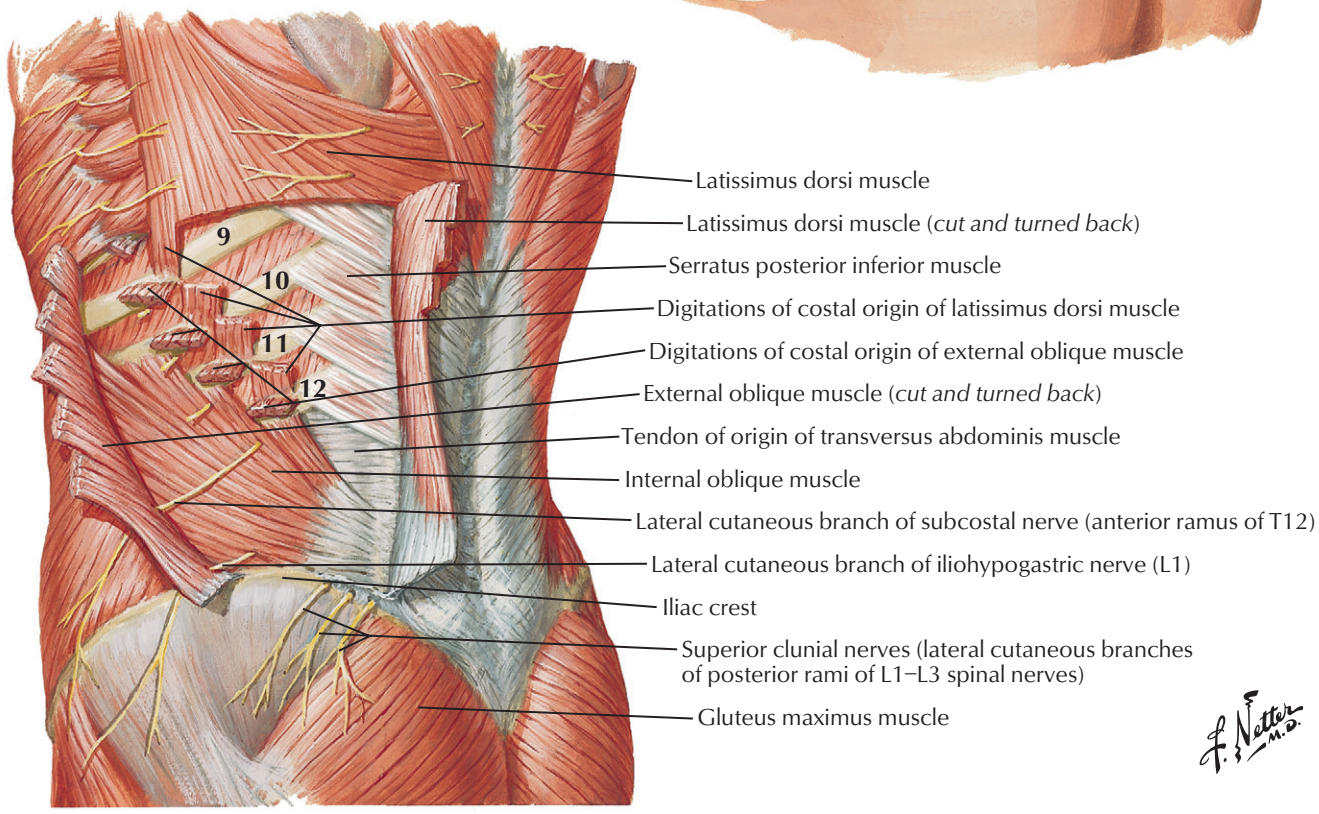
Aponeurosis of internal oblique muscle does not split at this level but passes completely anterior to rectus abdominis muscle and is fused there with both aponeurosis of external oblique muscle and that of transversus abdominis muscle. Thus, posterior wall of rectus sheath is absent below arcuate line, leaving only transversalis fascia.

Anterior Abdominal Wall: Internal View

See also Plates 362, 381

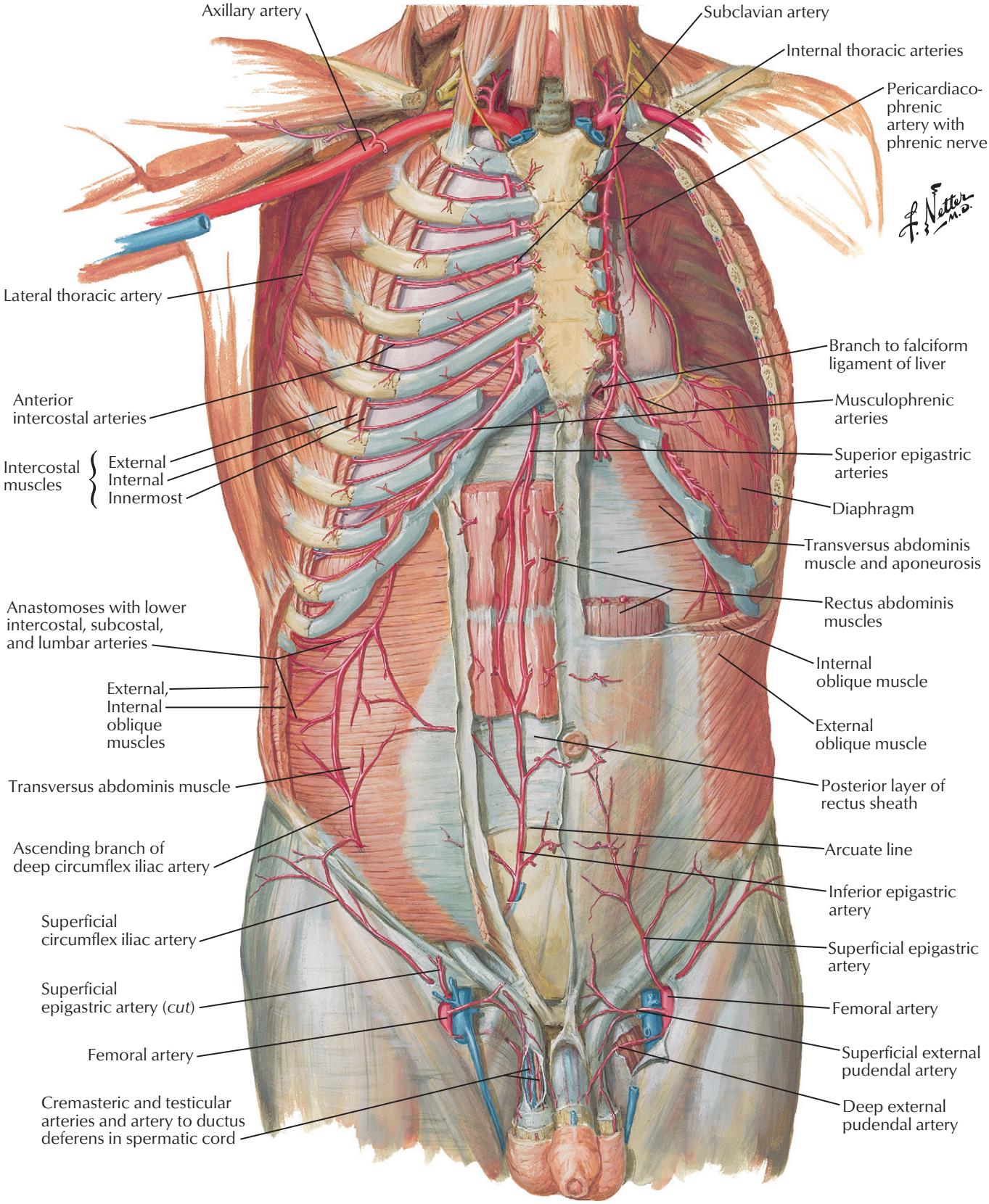



Serratus anterior muscle
Infraspinous fascia
Rhomboid major muscle
Auscultatory triangle
Lateral cutaneous branch of dorsal ramus of T7 spinal nerve
Medial cutaneous branch of dorsal ramus of T7 spinal nerve
Trapezius muscle
Latissimus dorsi muscle
External oblique muscle
Thoracolumbar fascia (posterior layer)
Lateral cutaneous branch of subcostal nerve (anterior ramus of T12)
Lumbar triangle (of Petit)
Iliac crest
Lateral cutaneous branch of iliohypogastric nerve (L1)
Superior clunial nerves (lateral cutaneous branches of posterior rami of L1–L3 spinal nerves)
Gluteal aponeurosis over gluteus medius muscle
Gluteus maximus muscle


9
10
11
12
Latissimus dorsi muscle
Latissimus dorsi muscle (cut and turned back)
Serratus posterior inferior muscle
Digitations of costal origin of latissimus dorsi muscle
Digitations of costal origin of external oblique muscle
External oblique muscle (cut and turned back)
Tendon of origin of transversus abdominis muscle
Internal oblique muscle
Lateral cutaneous branch of subcostal nerve (anterior ramus of T12)
Lateral cutaneous branch of iliohypogastric nerve (L1)
Iliac crest
Superior clunial nerves (lateral cutaneous branches of posterior rami of L1–L3 spinal nerves)
Gluteus maximus muscle

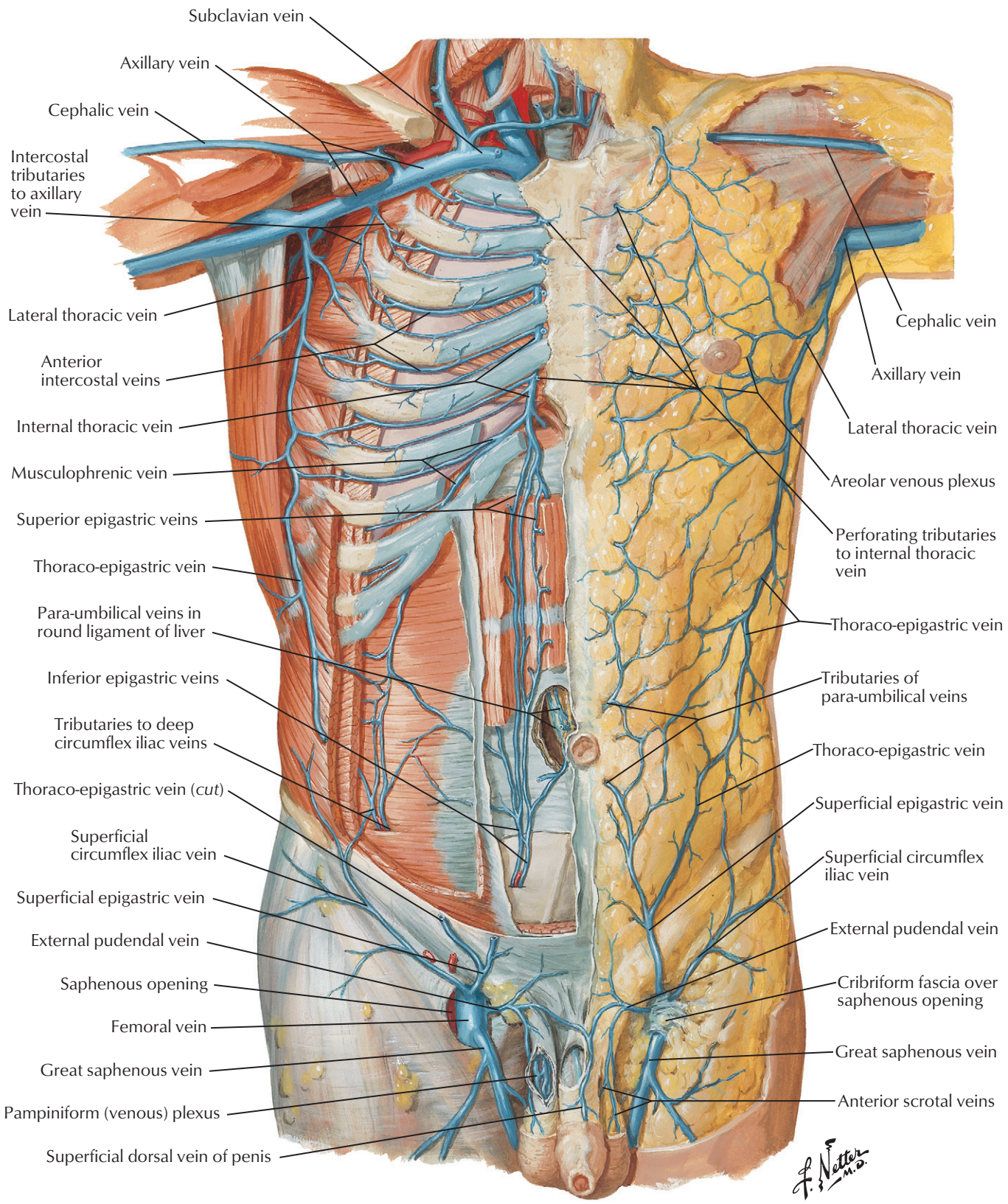
Arteries of Anterior Abdominal Wall

See also Plate 247



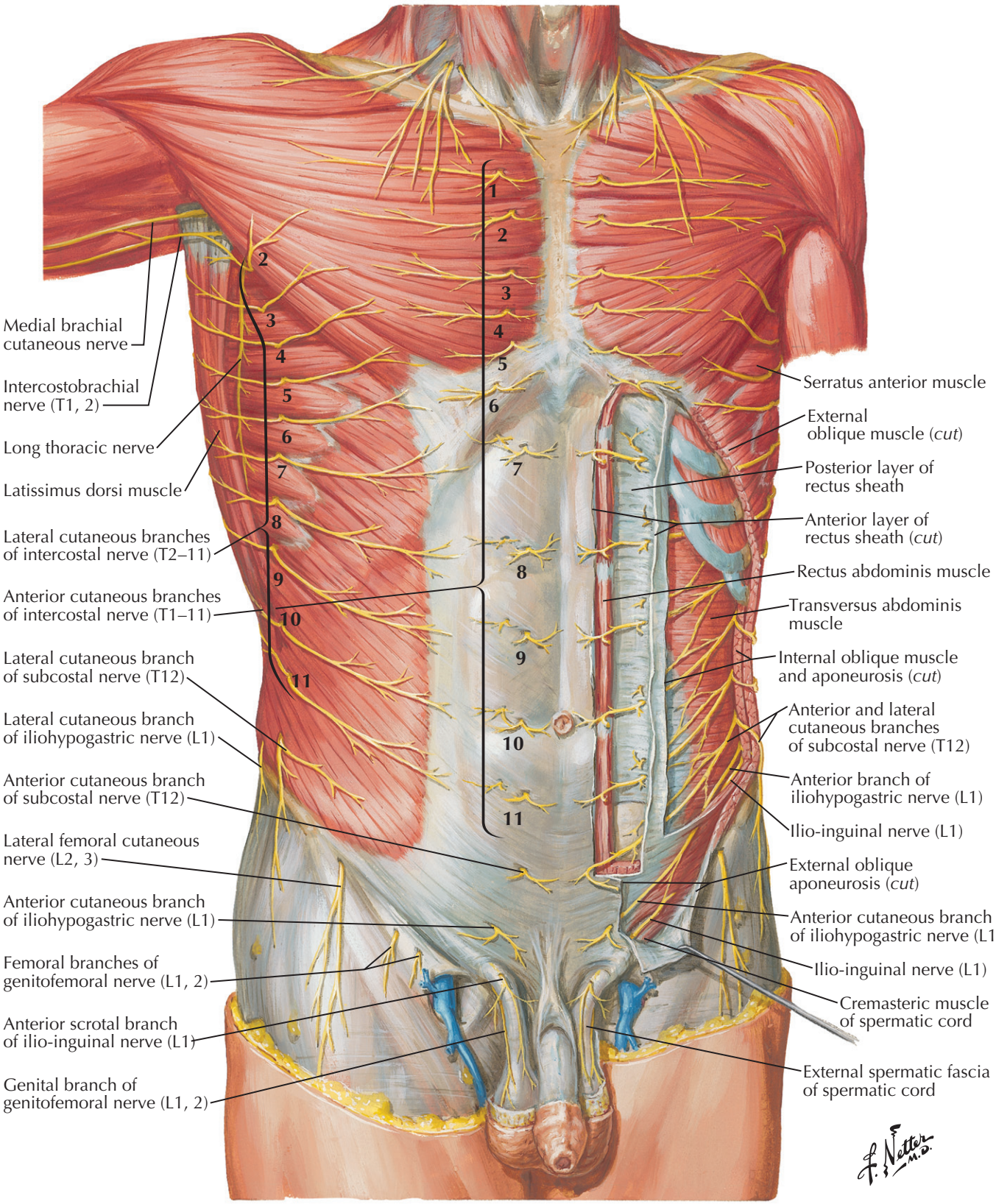
Veins of Anterior Abdominal Wall

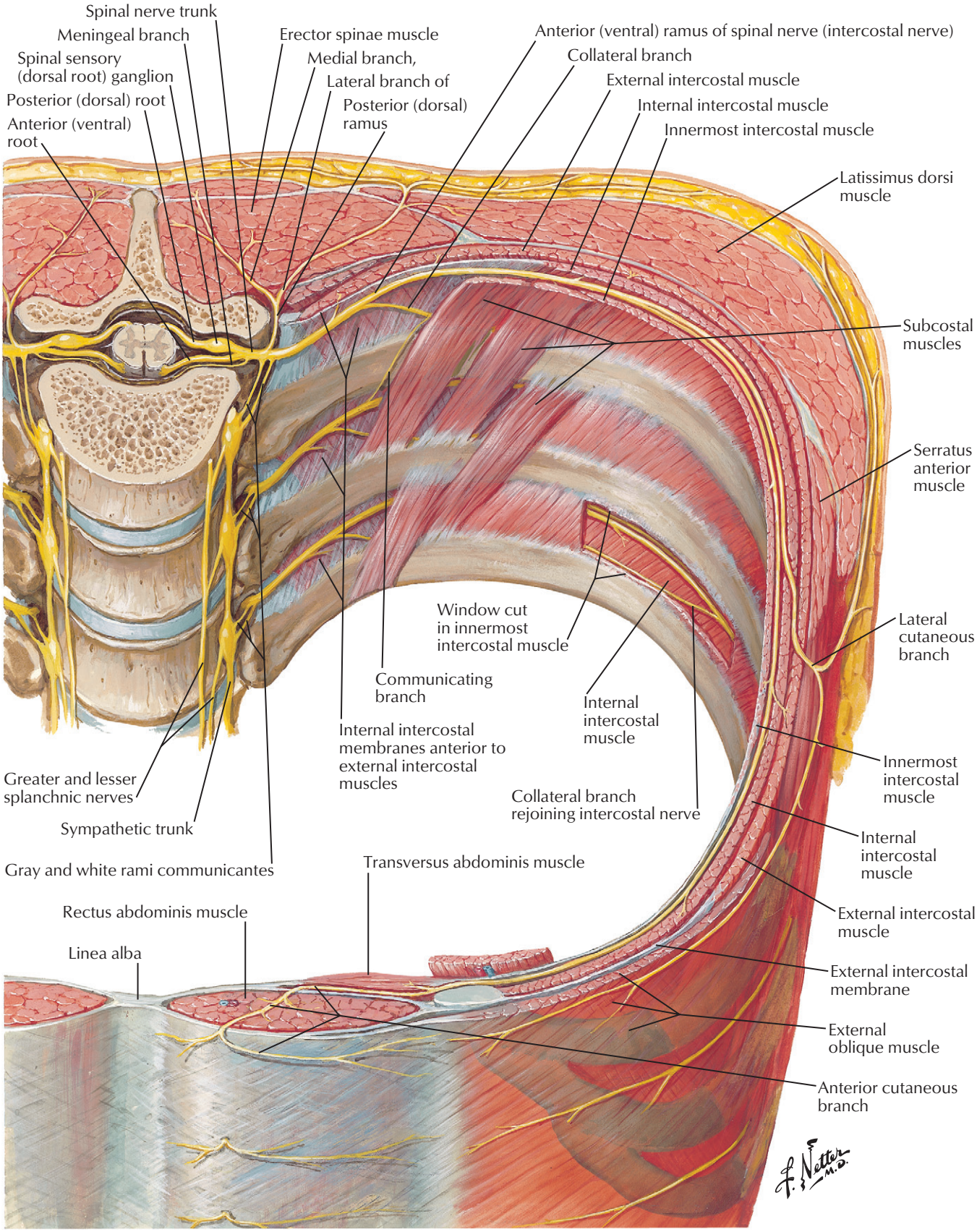
See also Plates 245, 248



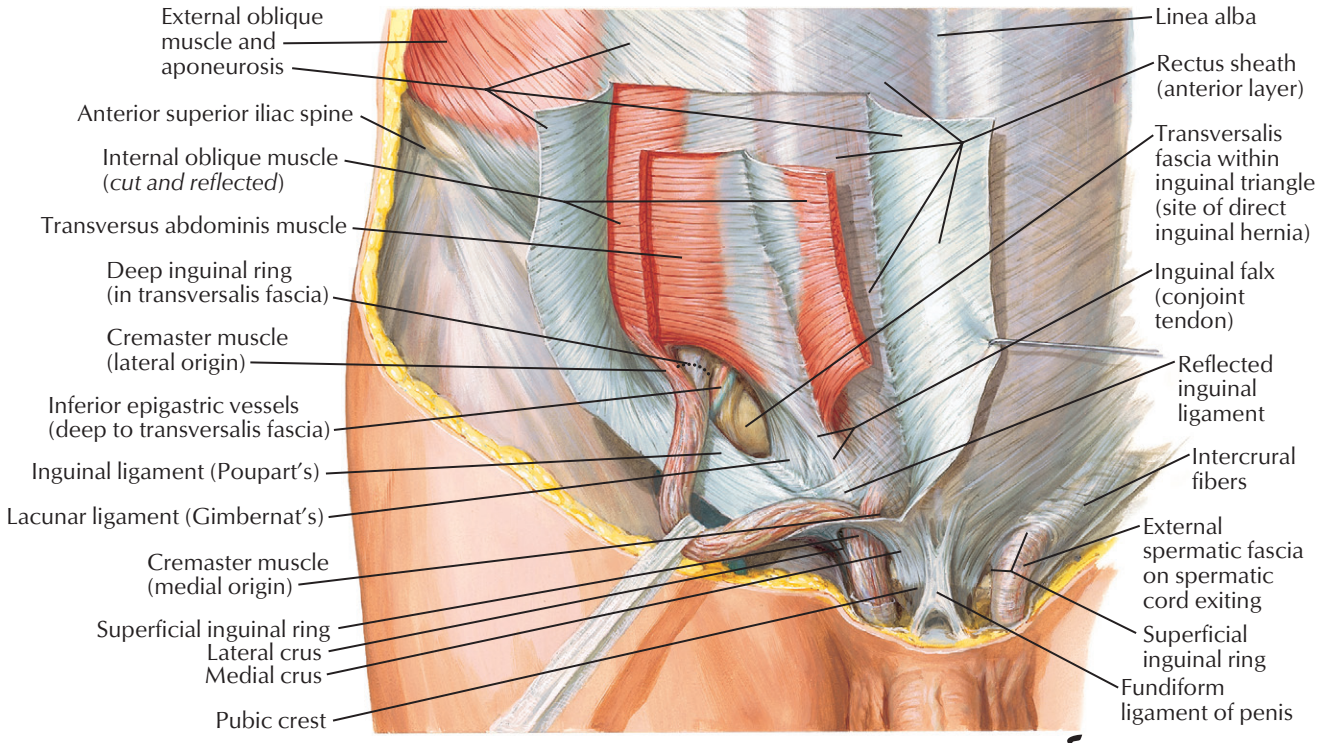
Nerves of Anterior Abdominal Wall

See also Plates 177, 185, 254



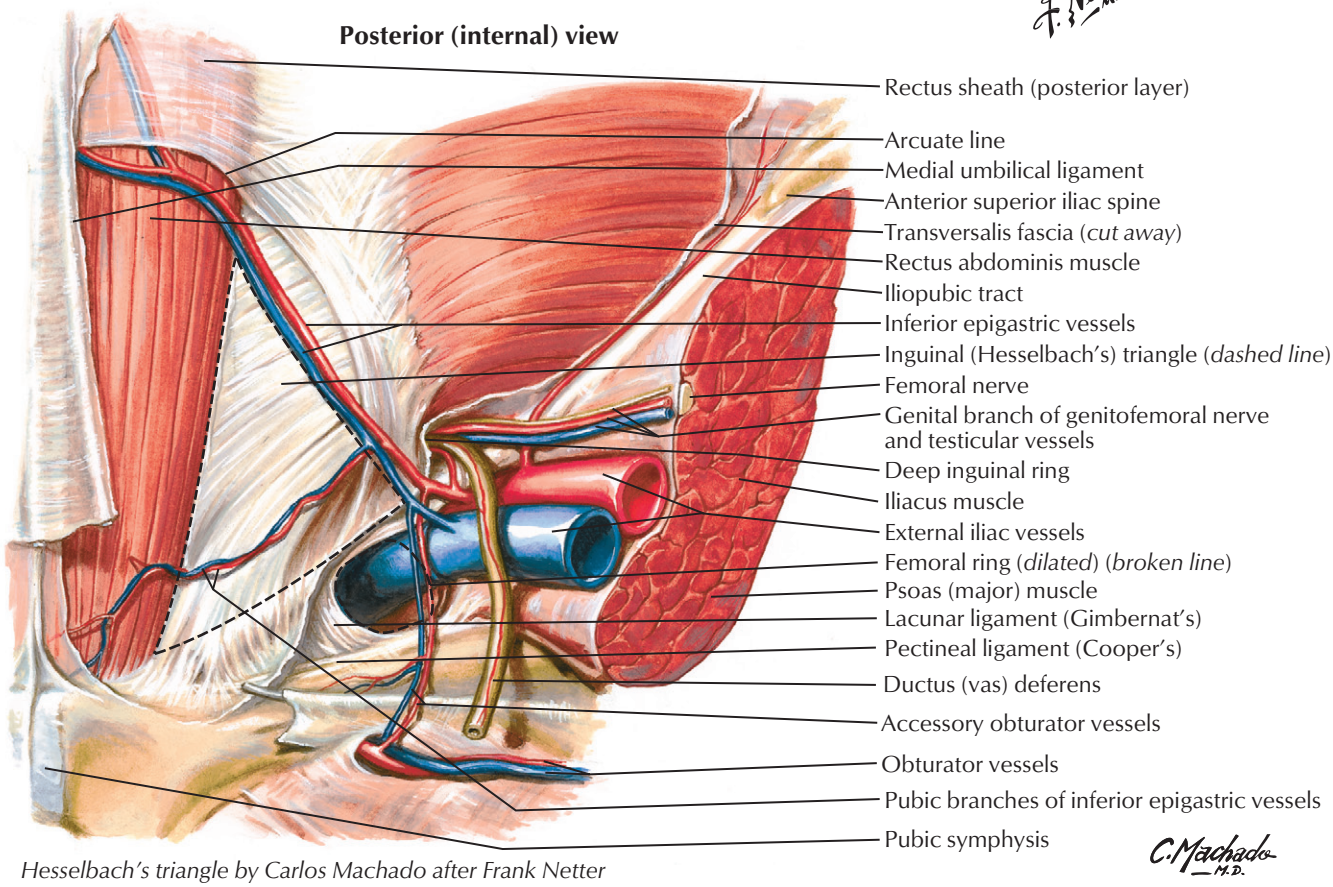

Spinal nerve trunk
Meningeal branch
Spinal sensory (dorsal root) ganglion
Posterior (dorsal) root
Anterior (ventral) root
Erector spinae muscle
Medial branch,
Lateral branch of Posterior (dorsal) ramus
Anterior (ventral) ramus of spinal nerve (intercostal nerve)
Collateral branch
External intercostal muscle
Internal intercostal muscle
Innermost intercostal muscle
Latissimus dorsi muscle
Subcostal muscles
Serratus anterior muscle
Lateral cutaneous branch
Window cut in innermost intercostal muscle
Communicating branch
Internal intercostal muscle
Internal intercostal membranes anterior to external intercostal muscles
Greater and lesser splanchnic nerves
Sympathetic trunk
Collateral branch rejoining intercostal nerve
Innermost intercostal muscle
Internal intercostal muscle
Gray and white rami communicantes
Transversus abdominis muscle
External intercostal muscle
Rectus abdominis muscle
Linea alba
External intercostal membrane
External oblique muscle
Anterior cutaneous branch
F. Netter M.D.

See also Plates 247, 249

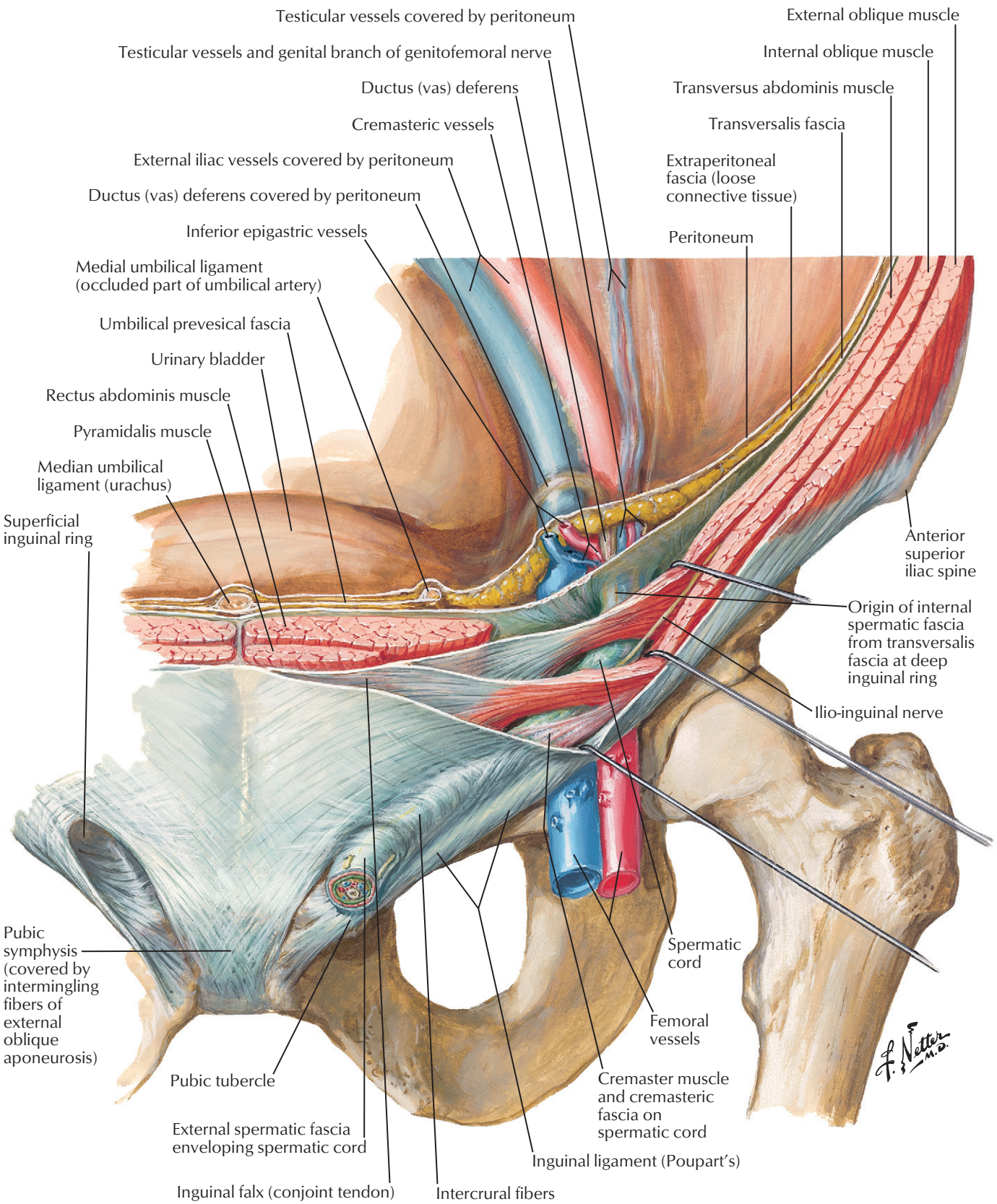


Anterior view

Posterior (internal) view

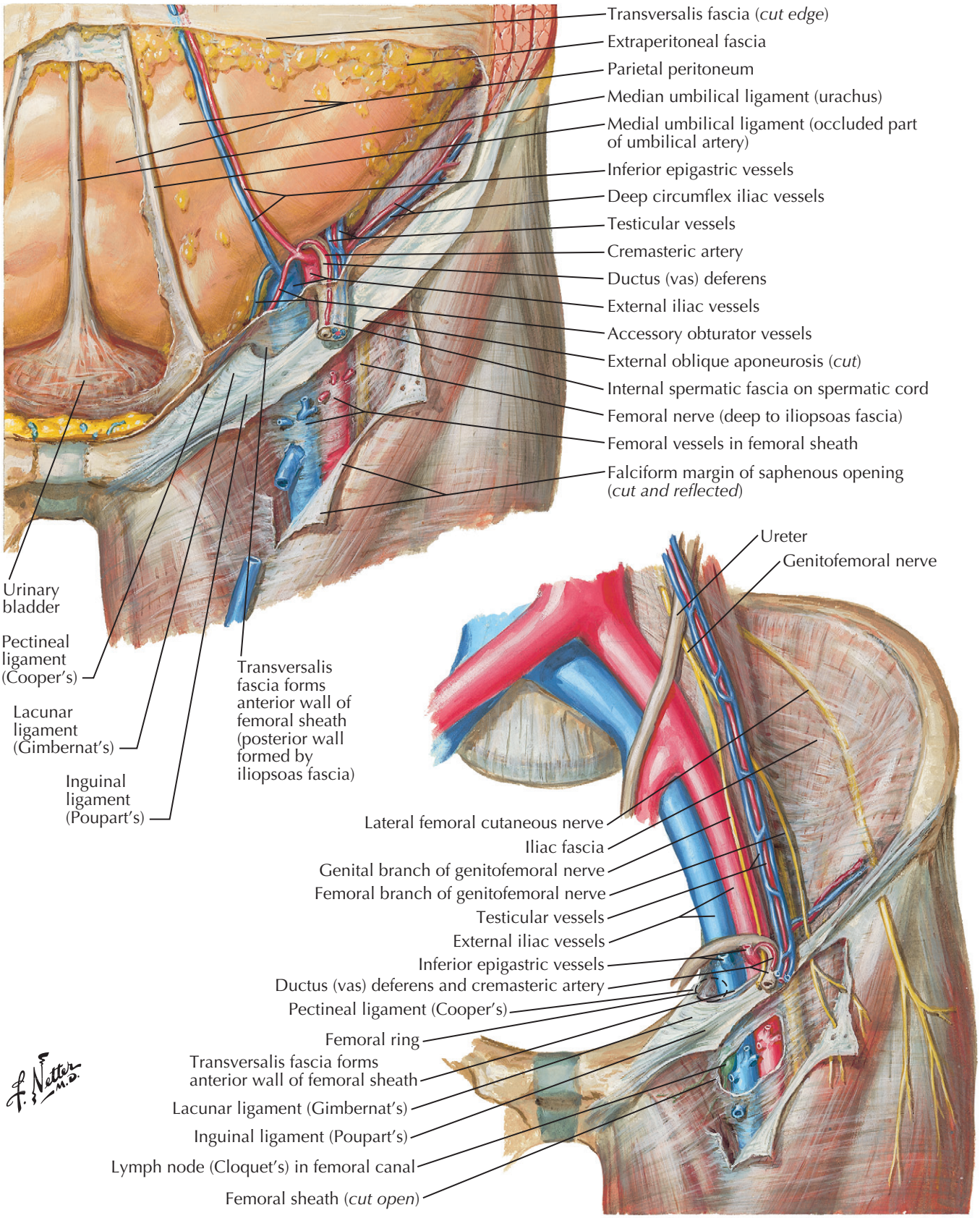


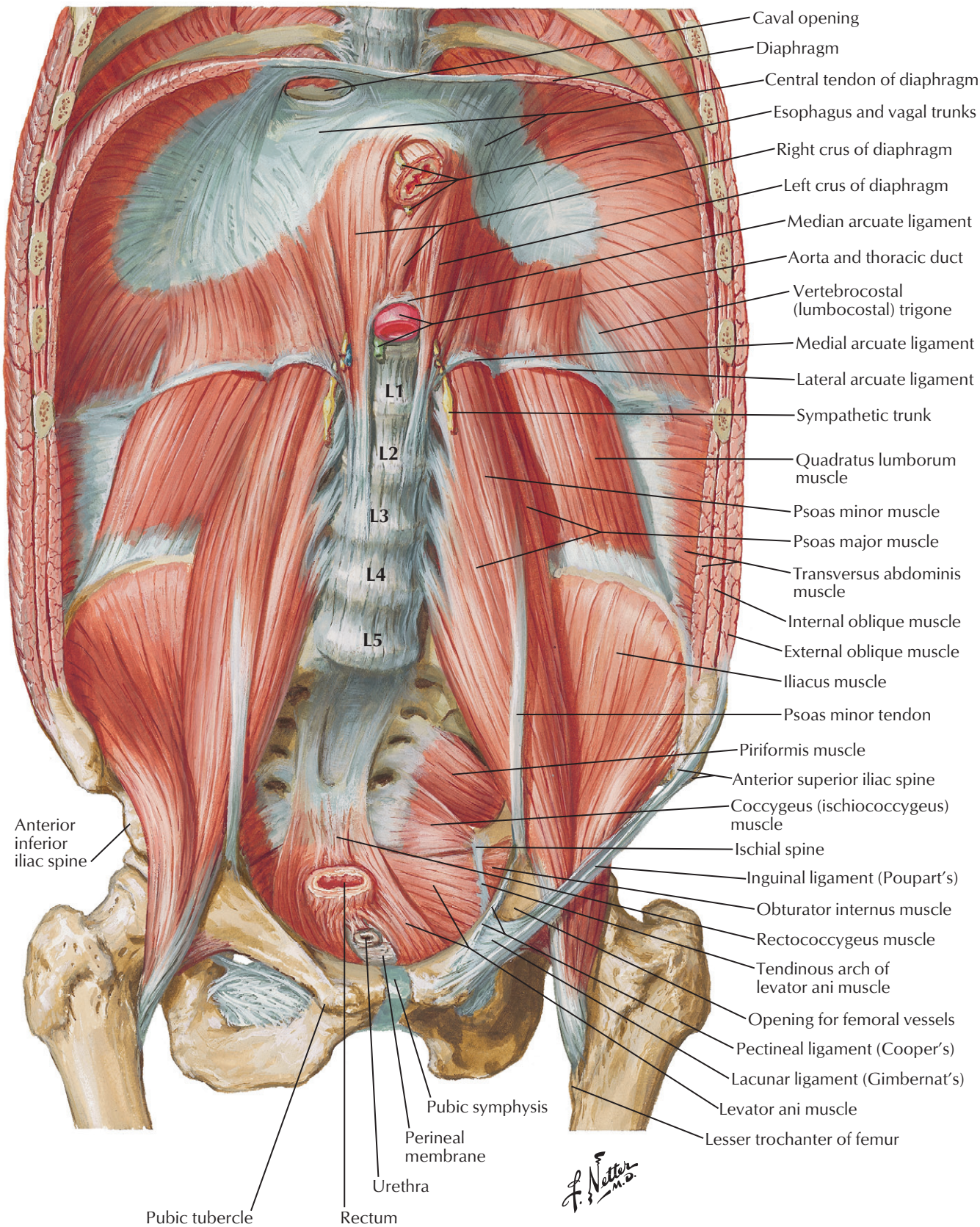
Hesselbach's triangle by Carlos Machado after Frank Netter


Testicular vessels covered by peritoneum
Testicular vessels and genital branch of genitofemoral nerve
Ductus (vas) deferens
Cremasteric vessels
External iliac vessels covered by peritoneum
Ductus (vas) deferens covered by peritoneum
Inferior epigastric vessels
Medial umbilical ligament (occluded part of umbilical artery)
Umbilical prevesical fascia
Urinary bladder
Rectus abdominis muscle
Pyramidalis muscle
Median umbilical ligament (urachus)
Superficial inguinal ring
Pubic symphysis (covered by intermingling fibers of external oblique aponeurosis)
Pubic tubercle
External spermatic fascia enveloping spermatic cord
Inguinal falx (conjoint tendon)
Intercrural fibers
Inguinal ligament (Poupart's)
Cremaster muscle and cremasteric fascia on spermatic cord
Femoral vessels
Spermatic cord
External oblique muscle
Internal oblique muscle
Transversus abdominis muscle
Transversalis fascia
Extraperitoneal fascia (loose connective tissue)
Peritoneum
Anterior superior iliac spine
Origin of internal spermatic fascia from transversalis fascia at deep inguinal ring
Ilio-inguinal nerve
F. Netter M.D.

Femoral Sheath and Inguinal Canal

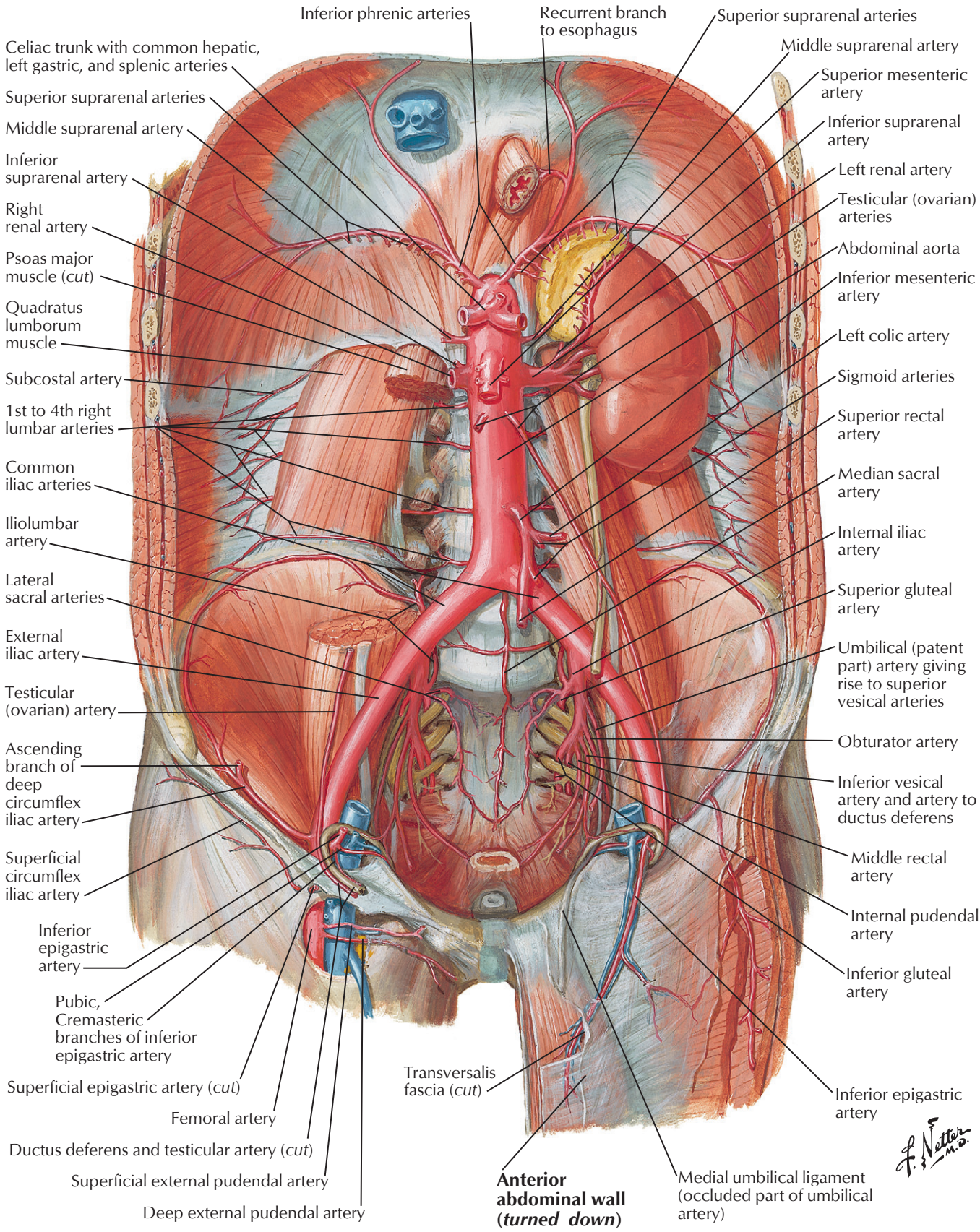
See also Plates 245, 247, 249




Caval opening
Diaphragm
Central tendon of diaphragm
Esophagus and vagal trunks
Right crus of diaphragm
Left crus of diaphragm
Median arcuate ligament
Aorta and thoracic duct
Vertebrocostal (lumbocostal) trigone
Medial arcuate ligament
Lateral arcuate ligament
Sympathetic trunk
Quadratus lumborum muscle
Psoas minor muscle
Psoas major muscle
Transversus abdominis muscle
Internal oblique muscle
External oblique muscle
Iliacus muscle
Psoas minor tendon
Piriformis muscle
Anterior superior iliac spine
Coccygeus (ischiococcygeus) muscle
Ischial spine
Inguinal ligament (Poupart's)
Obturator internus muscle
Rectococcygeus muscle
Tendinous arch of levator ani muscle
Opening for femoral vessels
Pectineal ligament (Cooper's)
Lacunar ligament (Gimbernat's)
Levator ani muscle
Lesser trochanter of femur
L1
L2
L3
L4
L5
Anterior inferior iliac spine
Pubic symphysis
Perineal membrane
Urethra
Pubic tubercle
Rectum
F. Netter M.D.

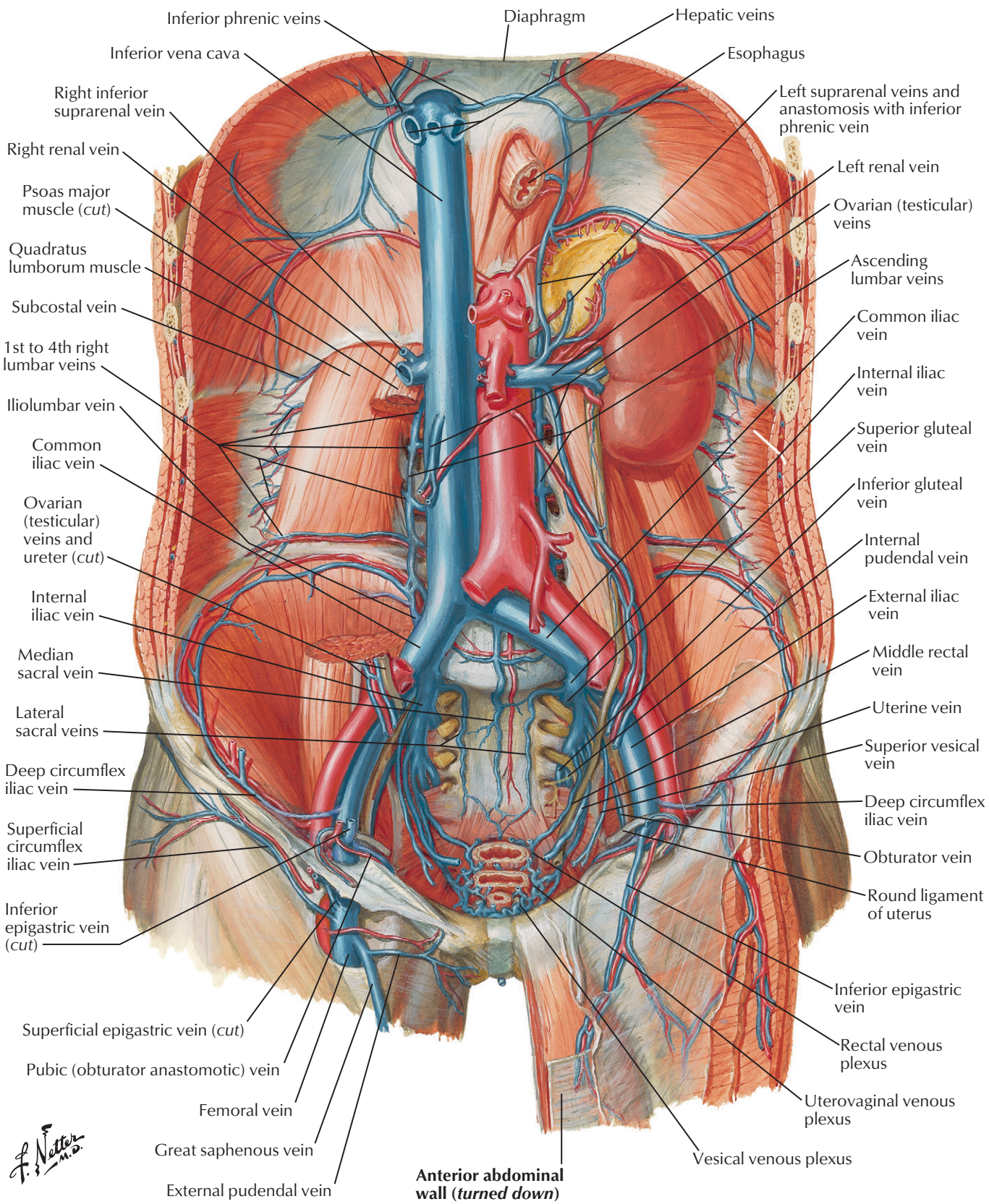
Arteries of Posterior Abdominal Wall

See also Plates 192, 374, 381



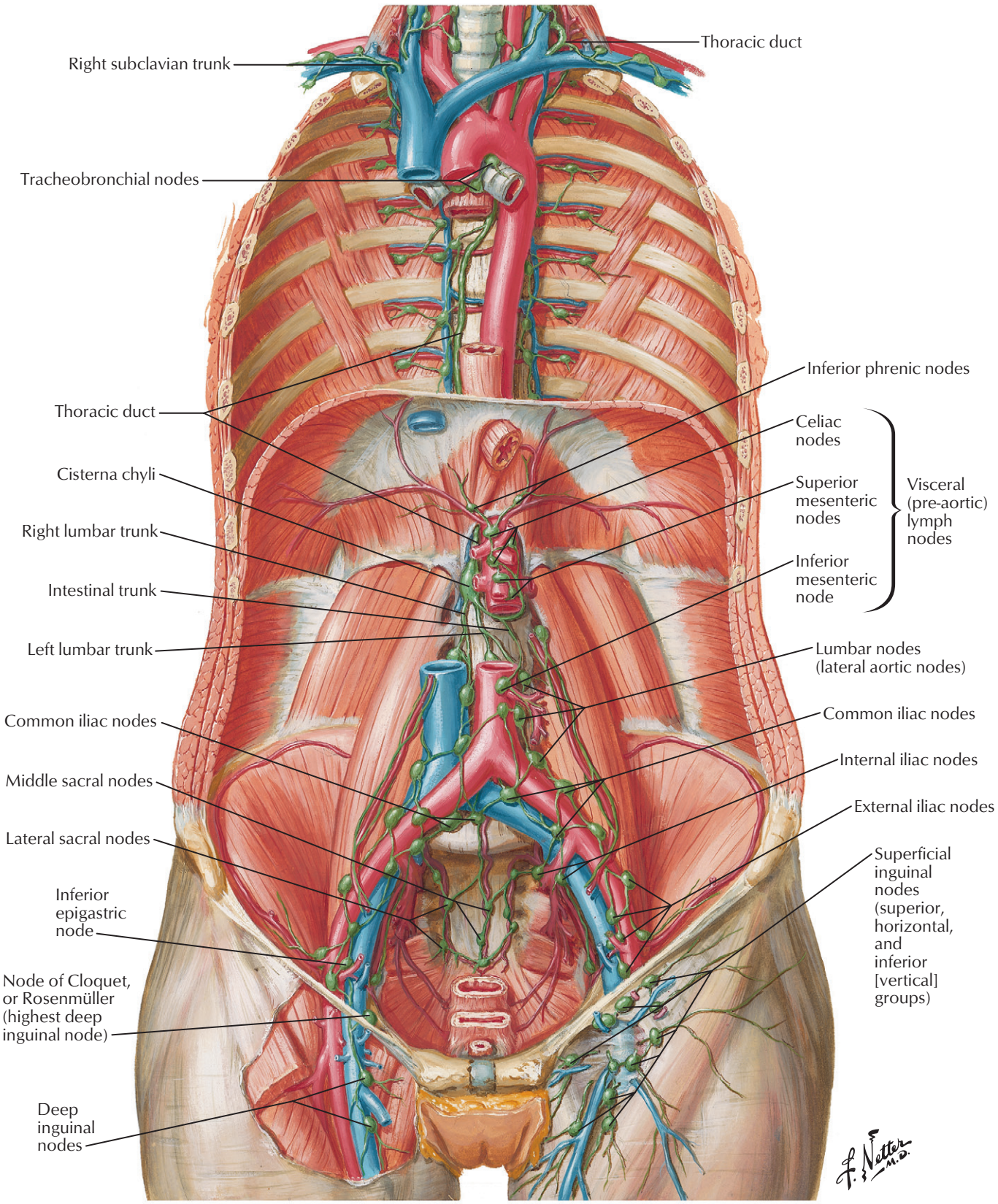
Veins of Posterior Abdominal Wall

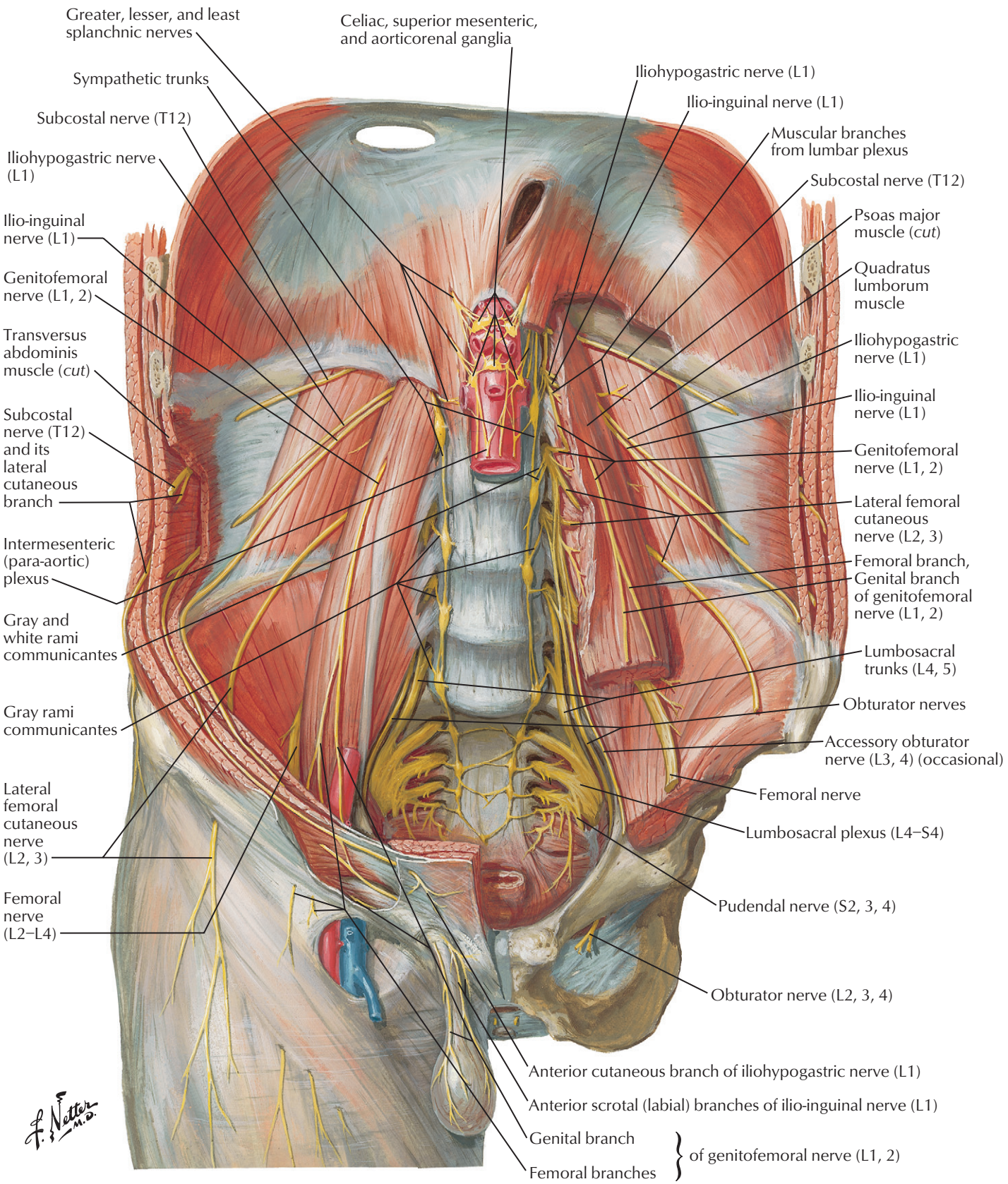
See also Plates 379, 381

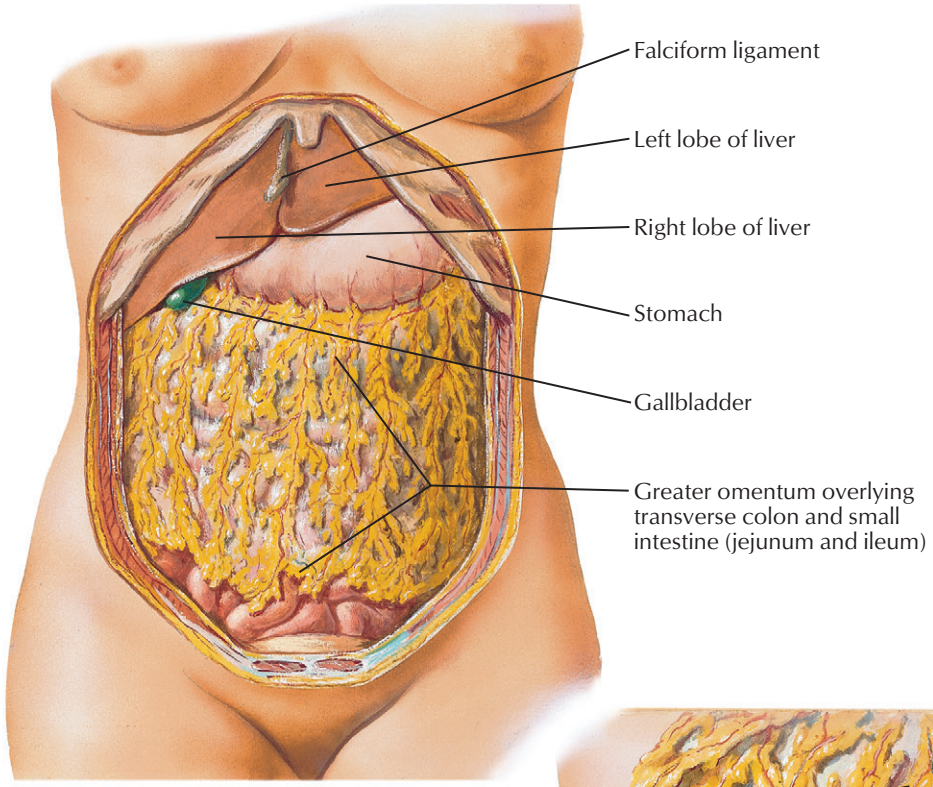


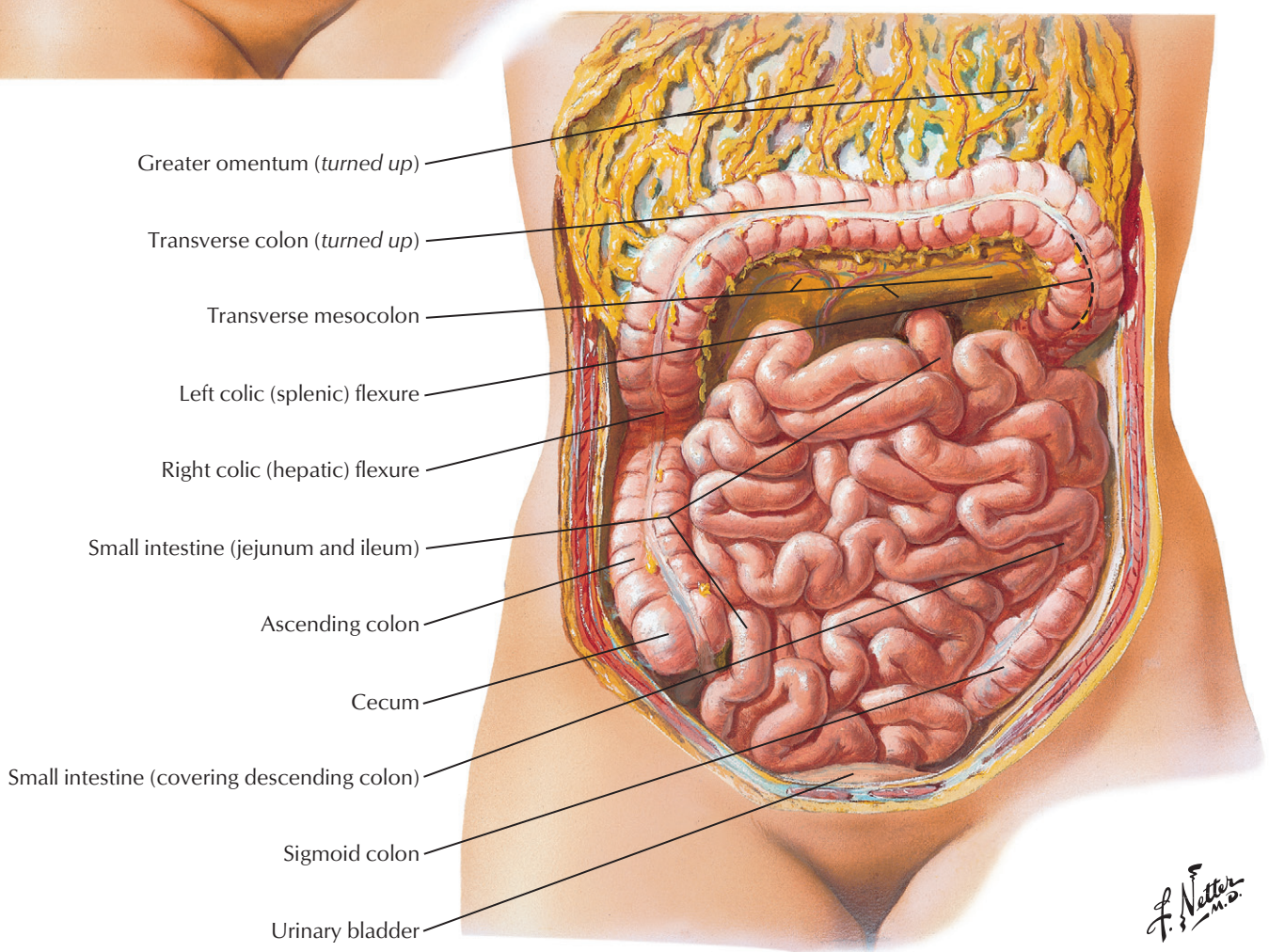
Lymph Vessels and Nodes of Posterior Abdominal Wall

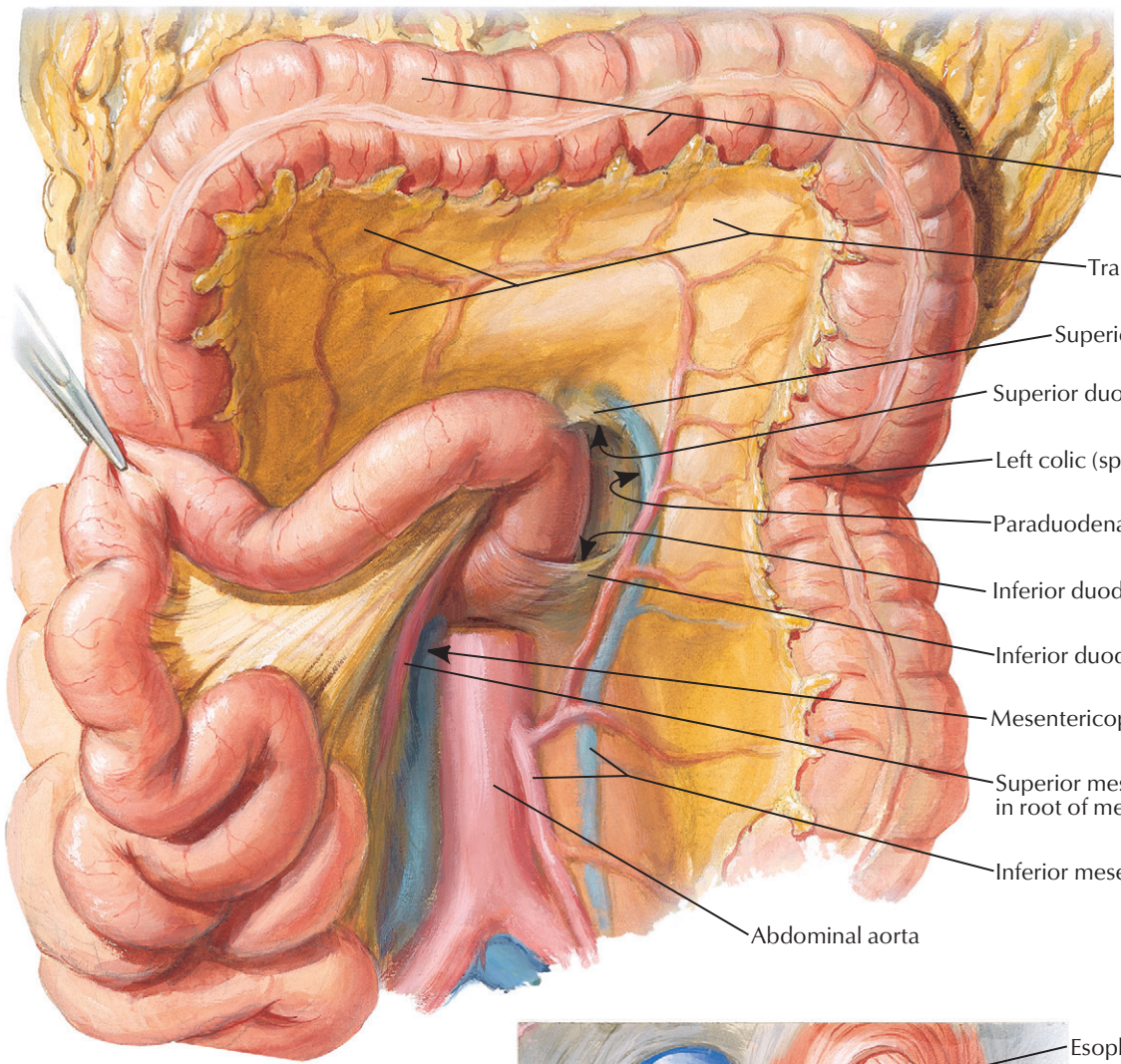
See also Plates 245, 384



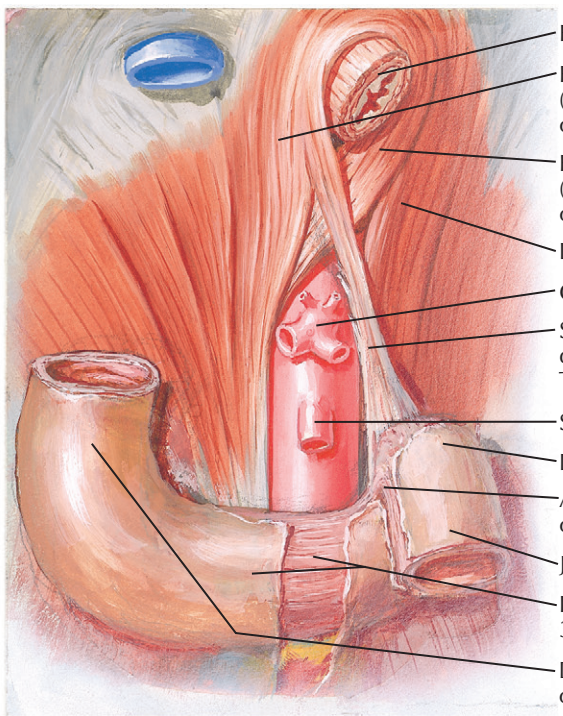

Greater, lesser, and least splanchnic nerves
Celiac, superior mesenteric, and aorticorenal ganglia
Sympathetic trunks
Iliohypogastric nerve (L1)
Ilio-inguinal nerve (L1)
Subcostal nerve (T12)
Muscular branches from lumbar plexus
Iliohypogastric nerve (L1)
Subcostal nerve (T12)
Ilio-inguinal nerve (L1)
Psoas major muscle (cut)
Genitofemoral nerve (L1, 2)
Quadratus lumborum muscle
Transversus abdominis muscle (cut)
Iliohypogastric nerve (L1)
Ilio-inguinal nerve (L1)
Subcostal nerve (T12) and its lateral cutaneous branch
Genitofemoral nerve (L1, 2)
Lateral femoral cutaneous nerve (L2, 3)
Intermesenteric (para-aortic) plexus
Femoral branch, Genital branch of genitofemoral nerve (L1, 2)
Gray and white rami communicantes
Lumbosacral trunks (L4, 5)
Gray rami communicantes
Obturator nerves
Accessory obturator nerve (L3, 4) (occasional)
Lateral femoral cutaneous nerve (L2, 3)
Femoral nerve
Lumbosacral plexus (L4–S4)
Femoral nerve (L2–L4)
Pudendal nerve (S2, 3, 4)
Obturator nerve (L2, 3, 4)
Anterior cutaneous branch of iliohypogastric nerve (L1)
Anterior scrotal (labial) branches of ilio-inguinal nerve (L1)
Genital branch
Femoral branches
of genitofemoral nerve (L1, 2)


Falciform ligament
Left lobe of liver
Right lobe of liver
Stomach
Gallbladder
Greater omentum overlying transverse colon and small intestine (jejunum and ileum)


Greater omentum (*turned up*)
Transverse colon (*turned up*)
Transverse mesocolon
Left colic (splenic) flexure
Right colic (hepatic) flexure
Small intestine (jejunum and ileum)
Ascending colon
Cecum
Small intestine (covering descending colon)
Sigmoid colon
Urinary bladder

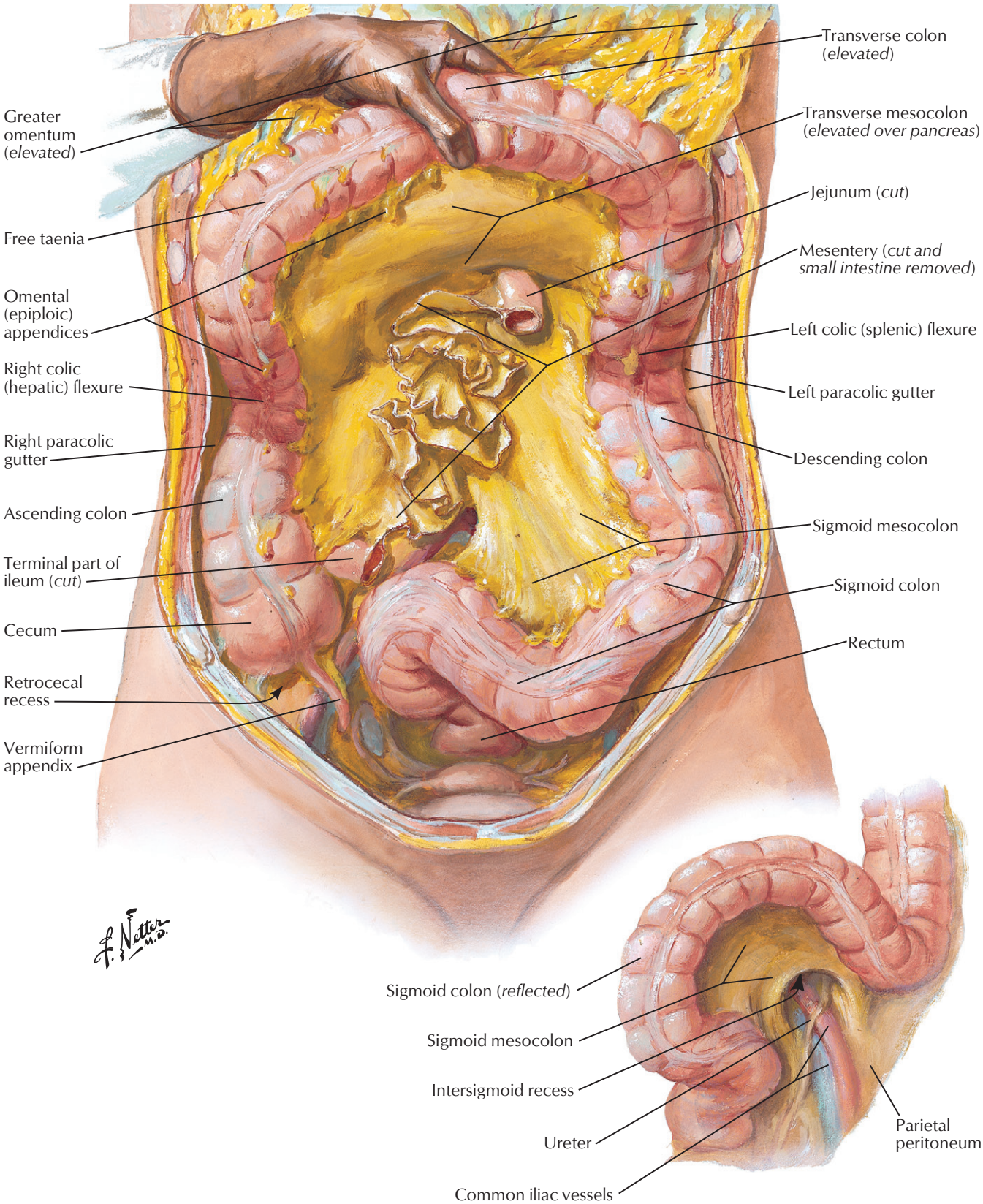


Exposure of suspensory muscle of duodenum (ligament of Treitz)



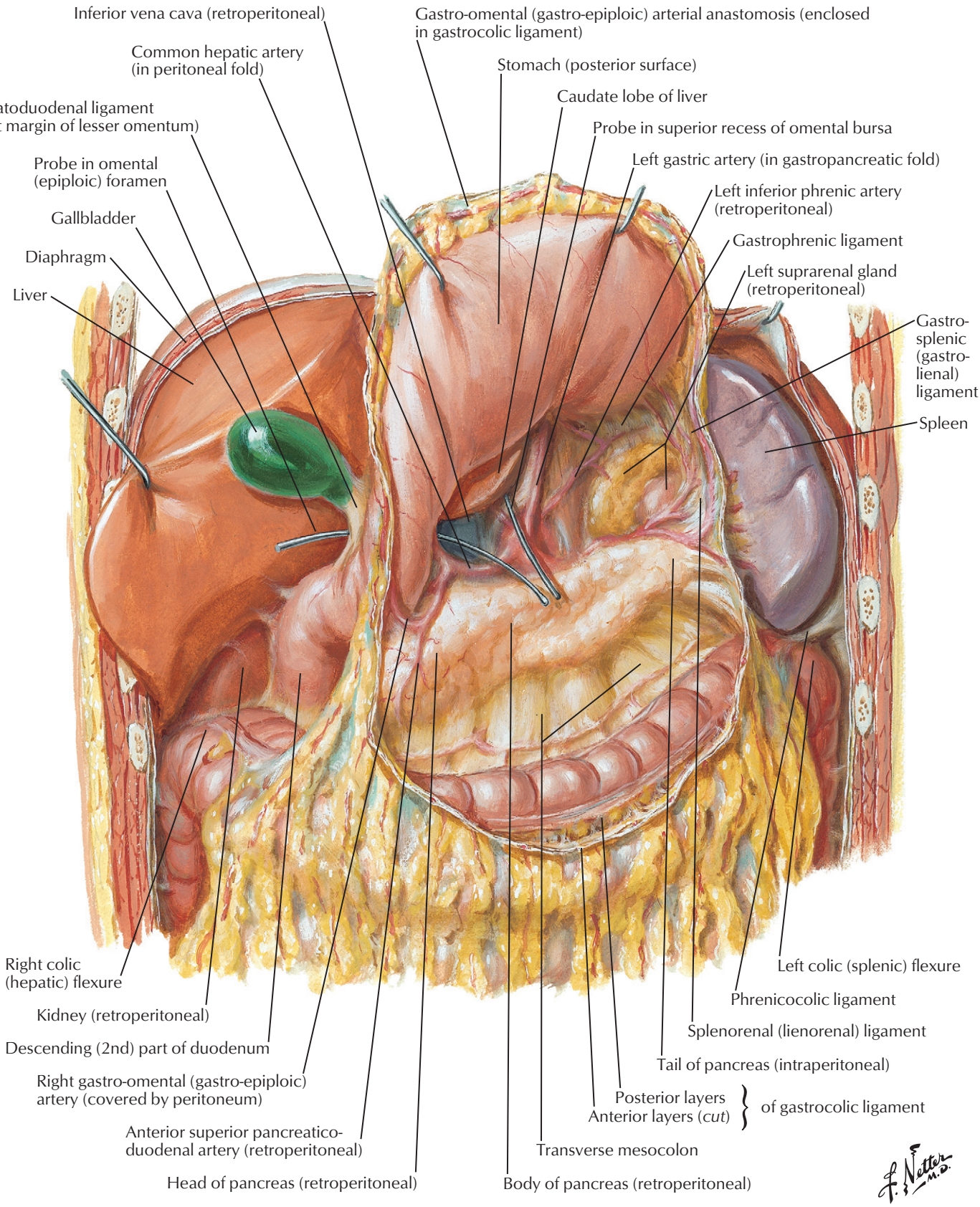
Mesenteric Relations of Intestines (continued)

See also Plate 268



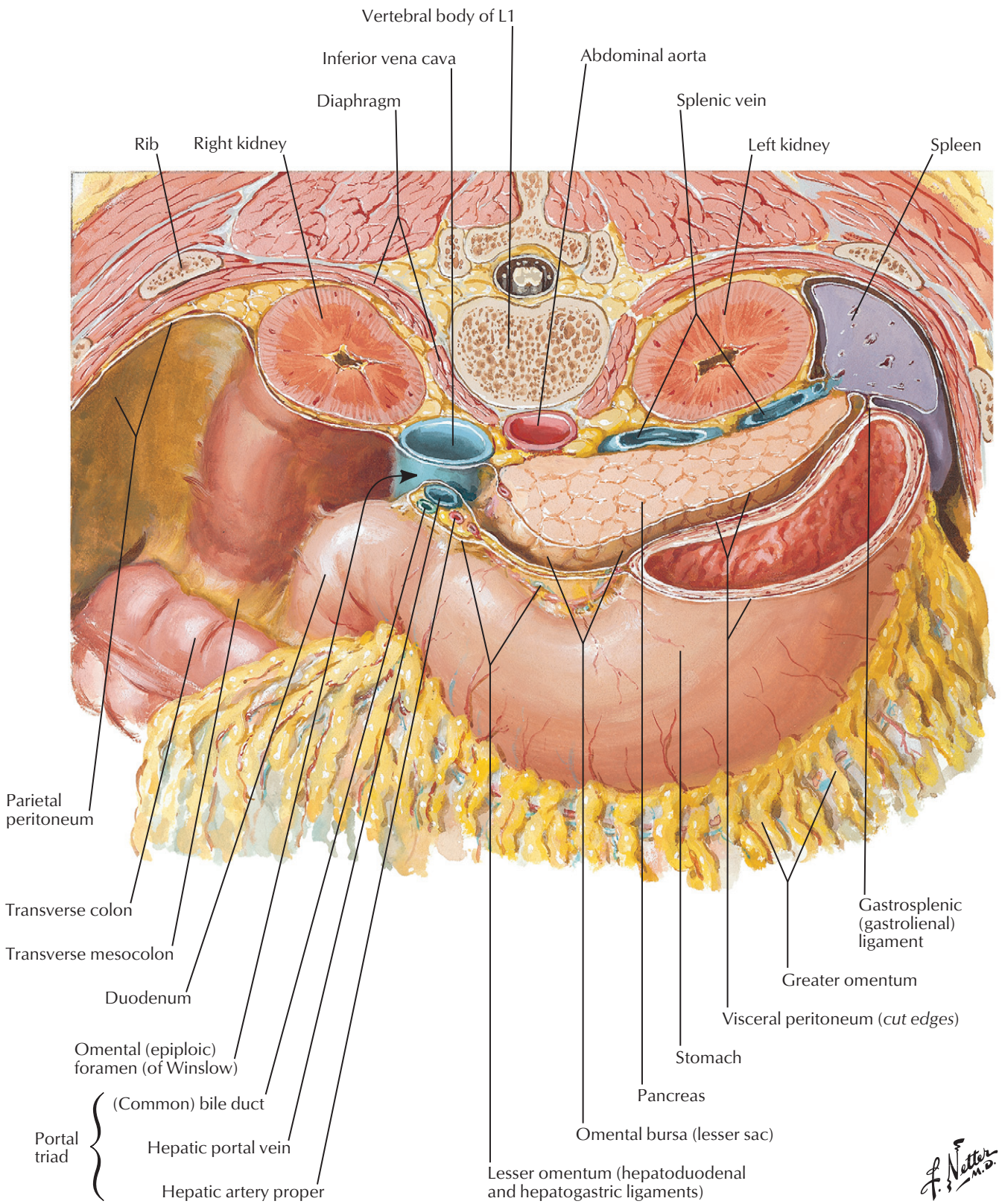
Omental Bursa: Stomach Reflected

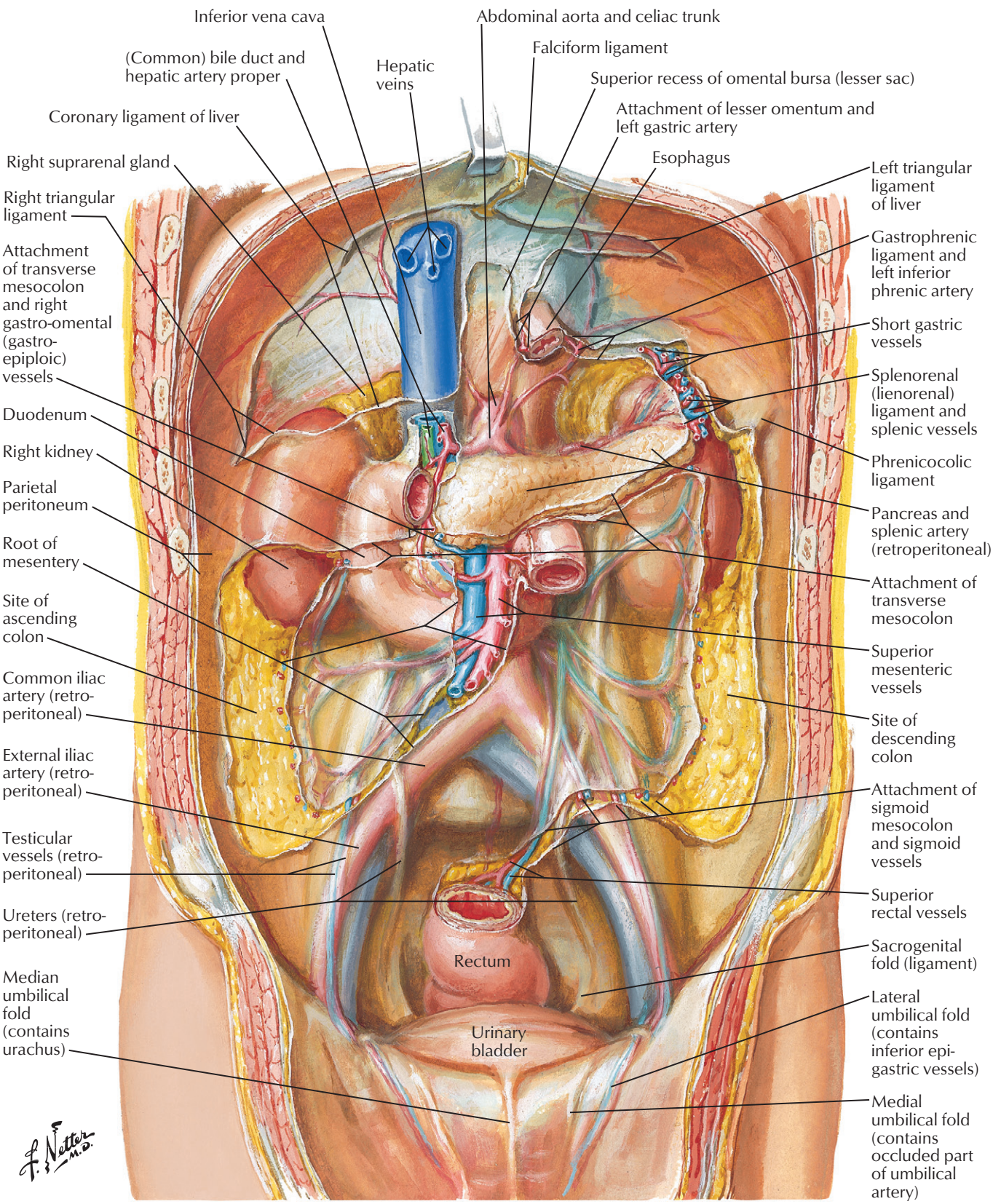
See also Plates 263, 264

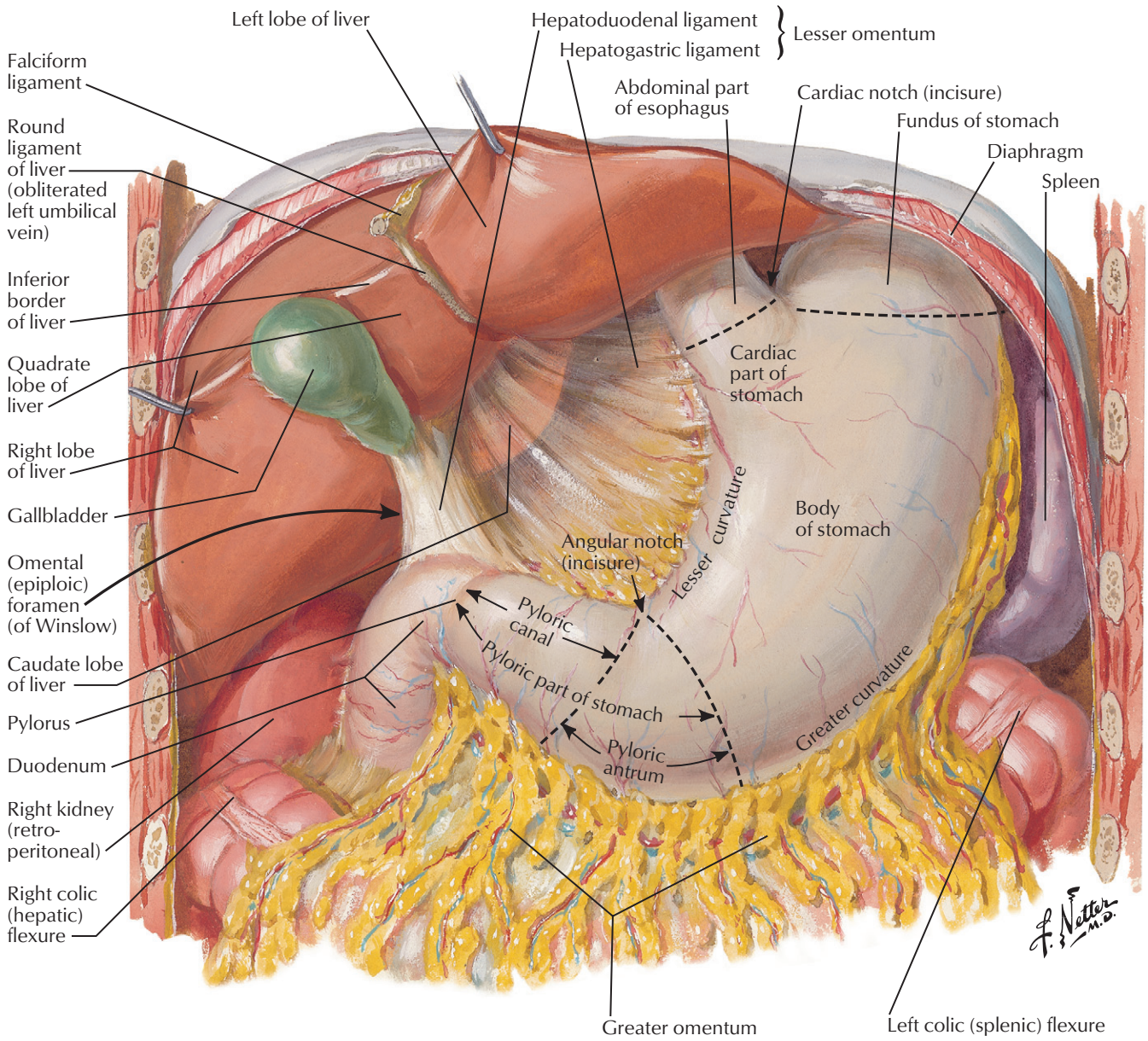


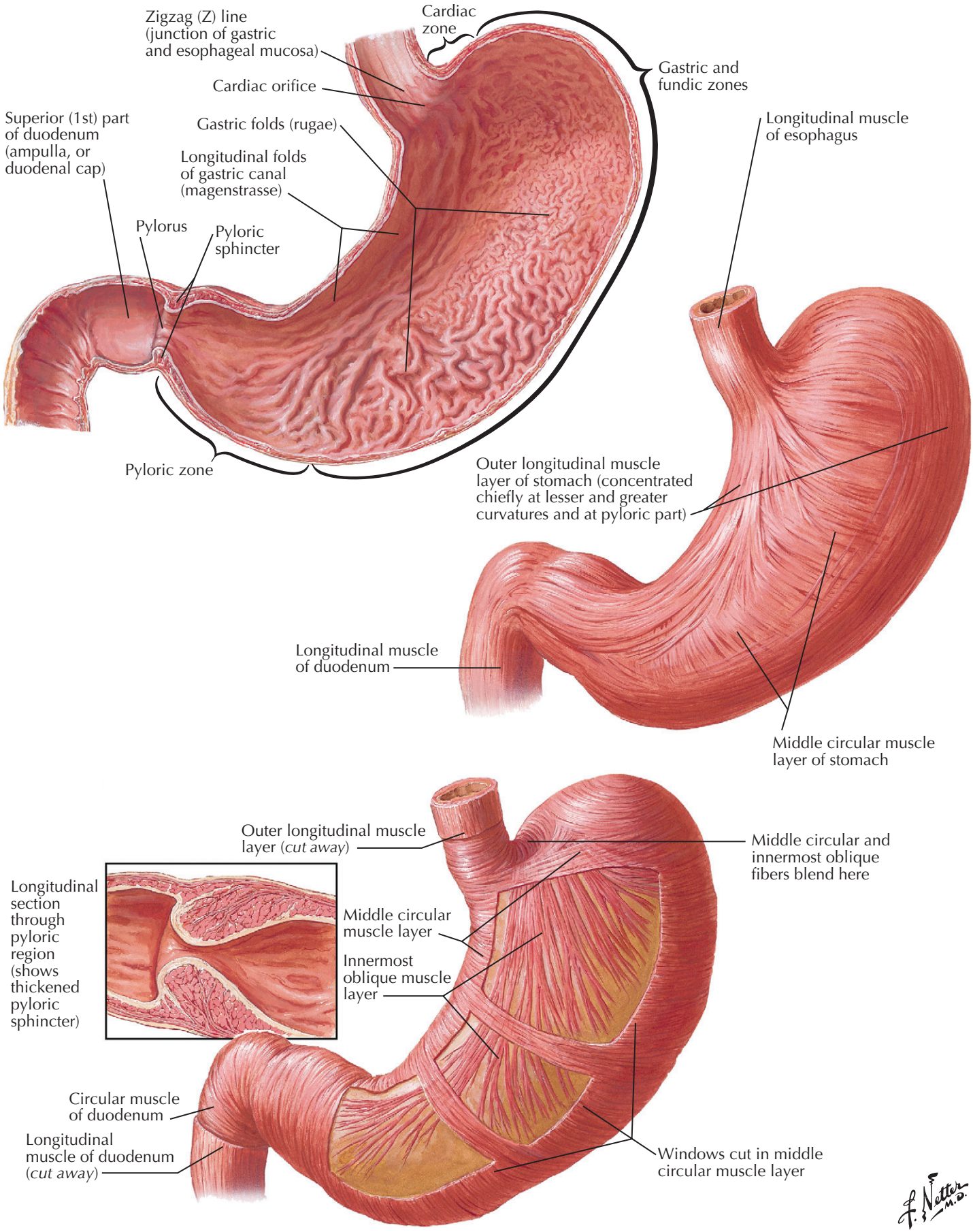
Omental Bursa: Cross Section

See also Plate 269



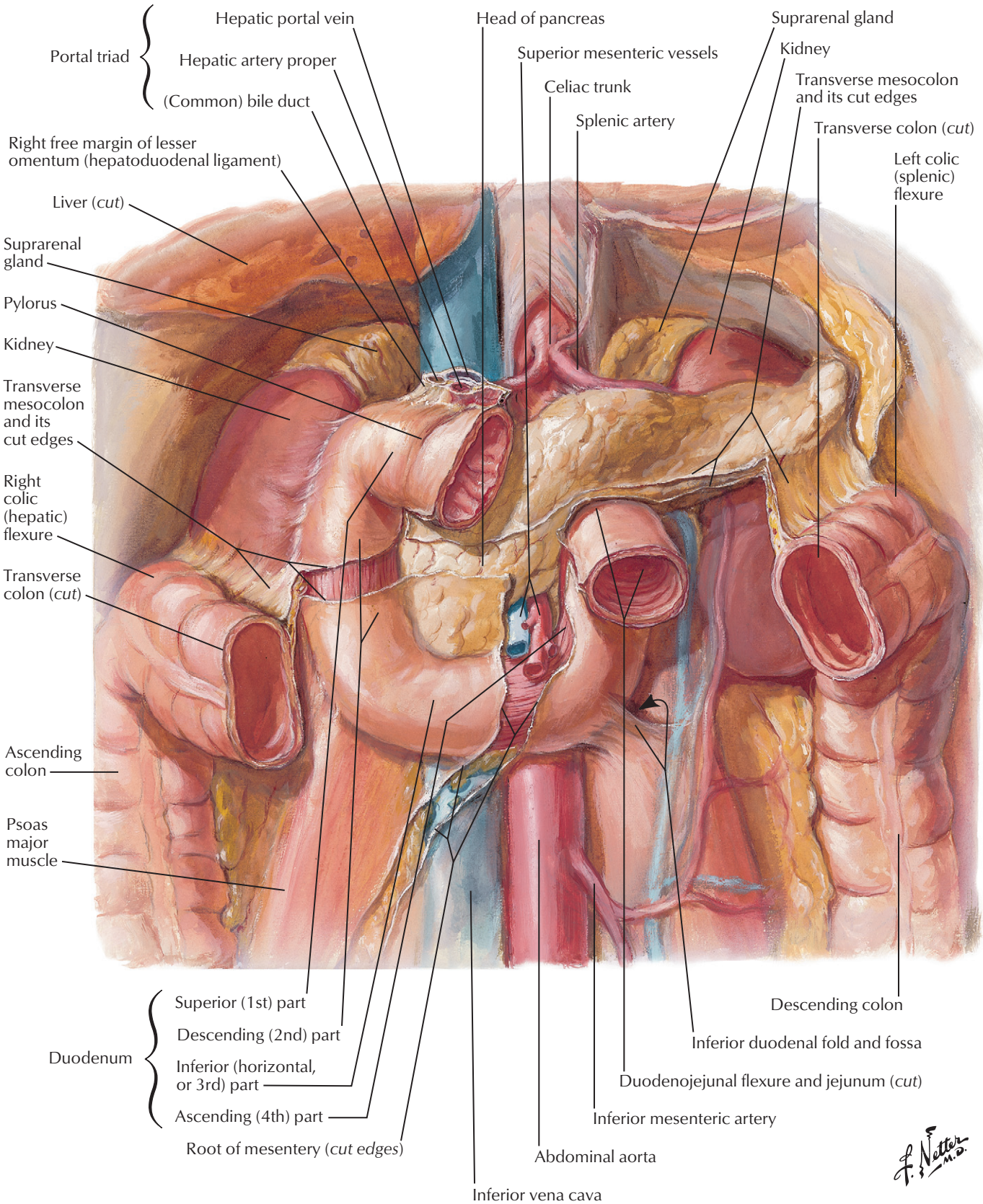

Inferior vena cava
Abdominal aorta and celiac trunk
(Common) bile duct and hepatic artery proper
Hepatic veins
Falciform ligament
Superior recess of omental bursa (lesser sac)
Coronary ligament of liver
Attachment of lesser omentum and left gastric artery
Right suprarenal gland
Esophagus
Left triangular ligament of liver
Right triangular ligament
Gastrophrenic ligament and left inferior phrenic artery
Attachment of transverse mesocolon and right gastro-omental (gastro-epiploic) vessels
Short gastric vessels
Splenorenal (lienorenal) ligament and splenic vessels
Duodenum
Phrenicocolic ligament
Right kidney
Pancreas and splenic artery (retroperitoneal)
Parietal peritoneum
Root of mesentery
Attachment of transverse mesocolon
Site of ascending colon
Superior mesenteric vessels
Common iliac artery (retro-peritoneal)
Site of descending colon
External iliac artery (retro-peritoneal)
Attachment of sigmoid mesocolon and sigmoid vessels
Testicular vessels (retro-peritoneal)
Superior rectal vessels
Ureters (retro-peritoneal)
Rectum
Sacrogenital fold (ligament)
Median umbilical fold (contains urachus)
Urinary bladder
Lateral umbilical fold (contains inferior epi-gastric vessels)
Medial umbilical fold (contains occluded part of umbilical artery)


Left lobe of liver
Hepatoduodenal ligament
Hepatogastric ligament
Lesser omentum
Falciform ligament
Abdominal part of esophagus
Cardiac notch (incisure)
Fundus of stomach
Diaphragm
Spleen
Round ligament of liver (obliterated left umbilical vein)
Inferior border of liver
Quadrate lobe of liver
Cardiac part of stomach
Right lobe of liver
Gallbladder
Lesser curvature
Body of stomach
Angular notch (incisure)
Omental (epiploic) foramen (of Winslow)
Pyloric canal
Pyloric part of stomach
Caudate lobe of liver
Greater curvature
Pylorus
Pyloric antrum
Duodenum
Right kidney (retro-peritoneal)
Right colic (hepatic) flexure
Greater omentum
Left colic (splenic) flexure


Zigzag (Z) line (junction of gastric and esophageal mucosa)
Cardiac zone
Cardiac orifice
Gastric and fundic zones
Superior (1st) part of duodenum (ampulla, or duodenal cap)
Gastric folds (rugae)
Longitudinal folds of gastric canal (magenstrasse)
Pylorus
Pyloric sphincter
Pyloric zone
Longitudinal muscle of esophagus
Outer longitudinal muscle layer of stomach (concentrated chiefly at lesser and greater curvatures and at pyloric part)
Longitudinal muscle of duodenum
Middle circular muscle layer of stomach
Outer longitudinal muscle layer (cut away)
Middle circular and innermost oblique fibers blend here
Longitudinal section through pyloric region (shows thickened pyloric sphincter)
Middle circular muscle layer
Innermost oblique muscle layer
Circular muscle of duodenum
Longitudinal muscle of duodenum (cut away)
Windows cut in middle circular muscle layer

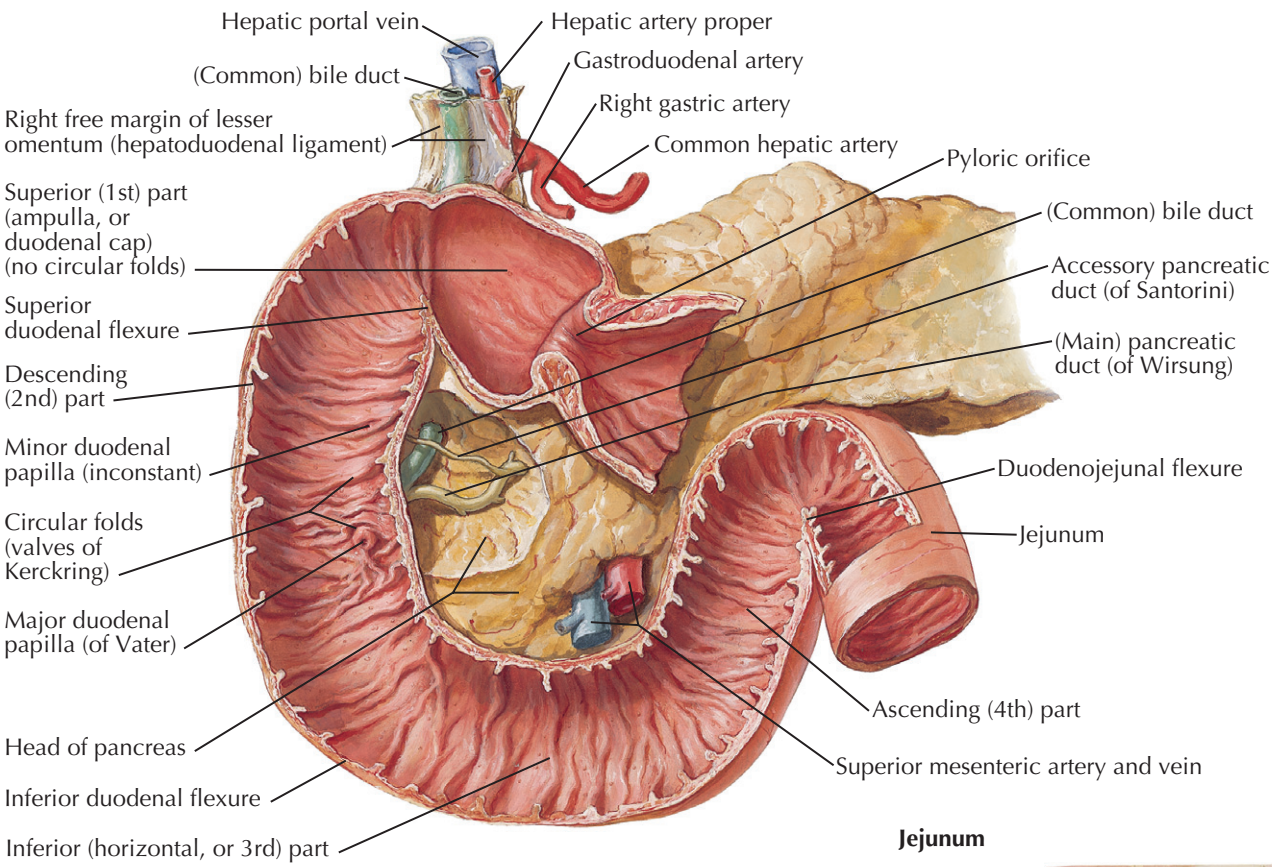
Duodenum in Situ

See also Plate 268

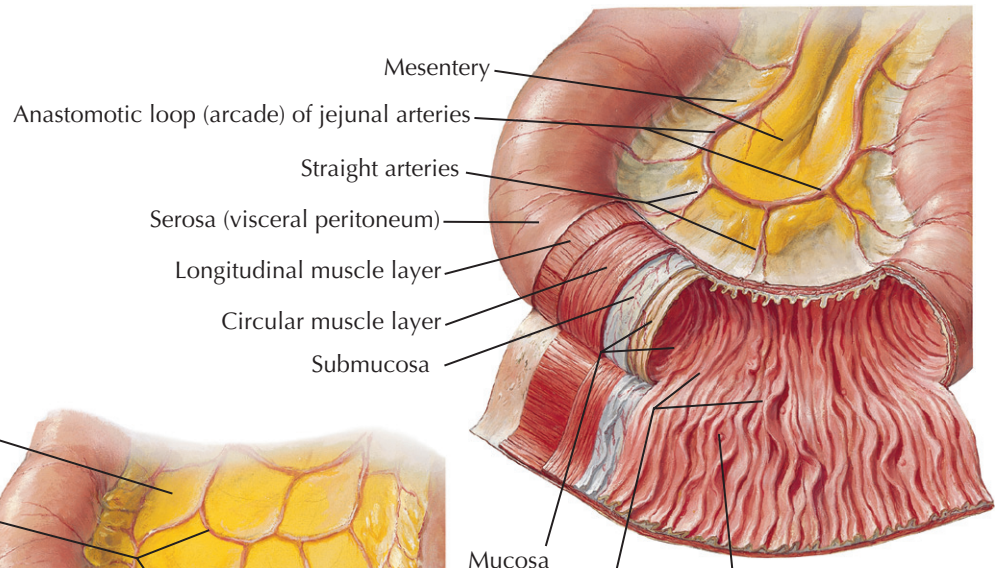


Mucosa and Musculature of Duodenum

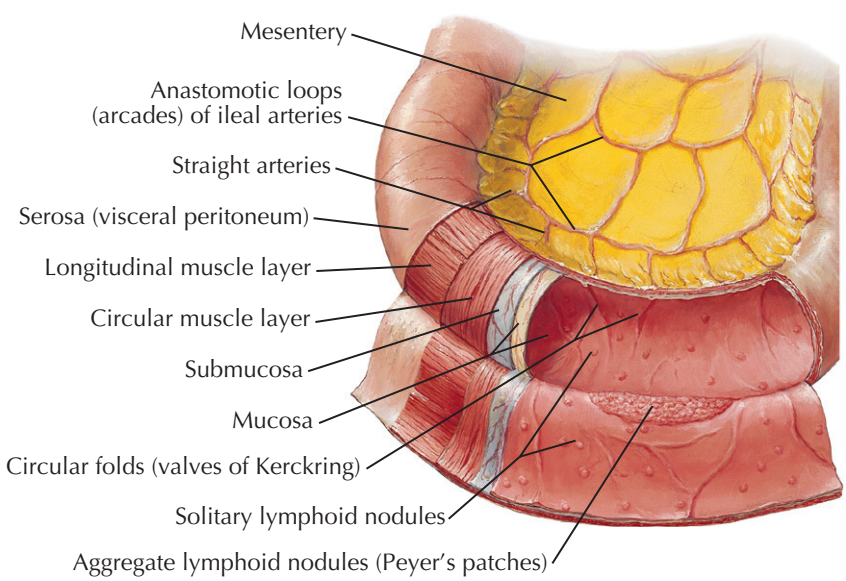
See also Plate 270

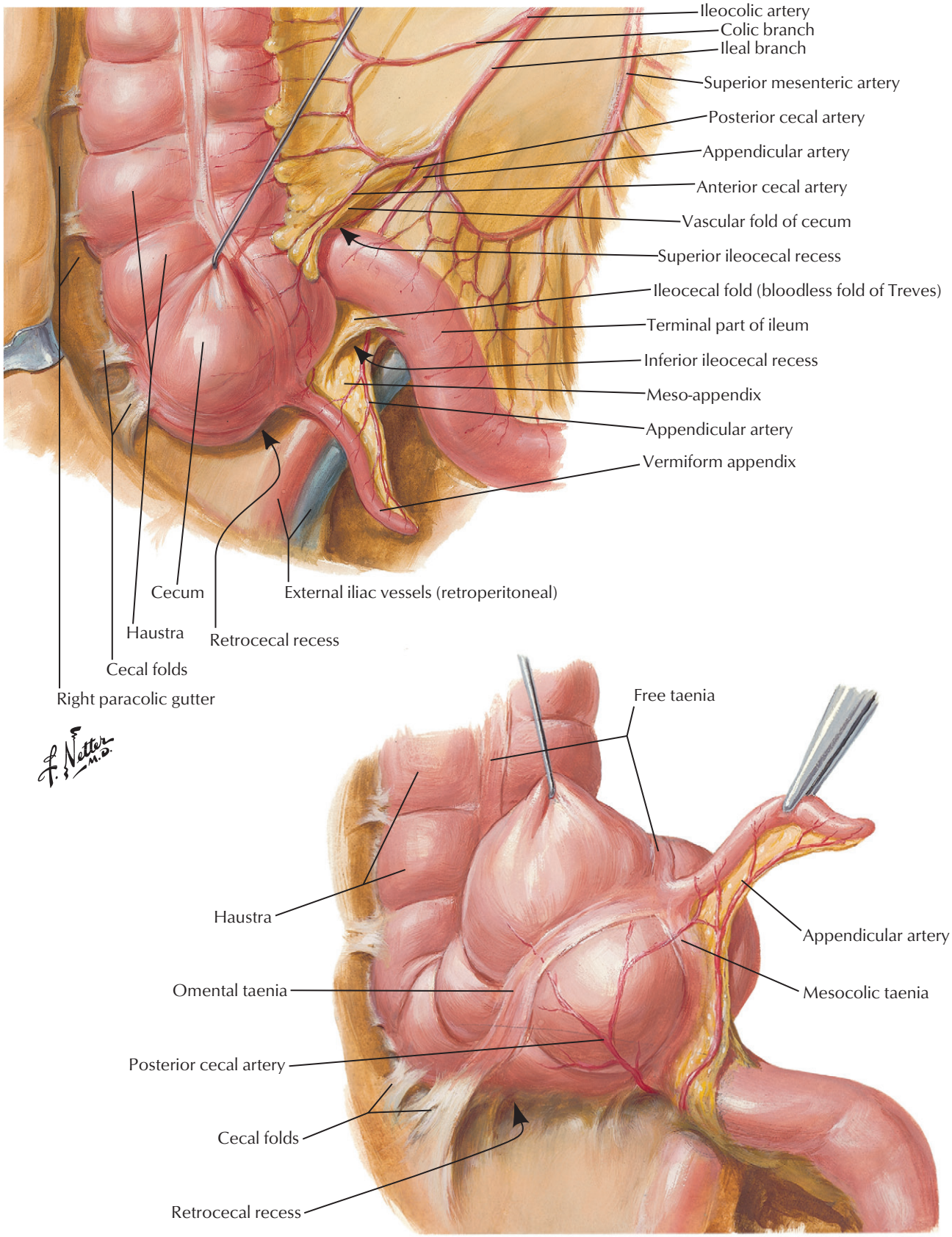


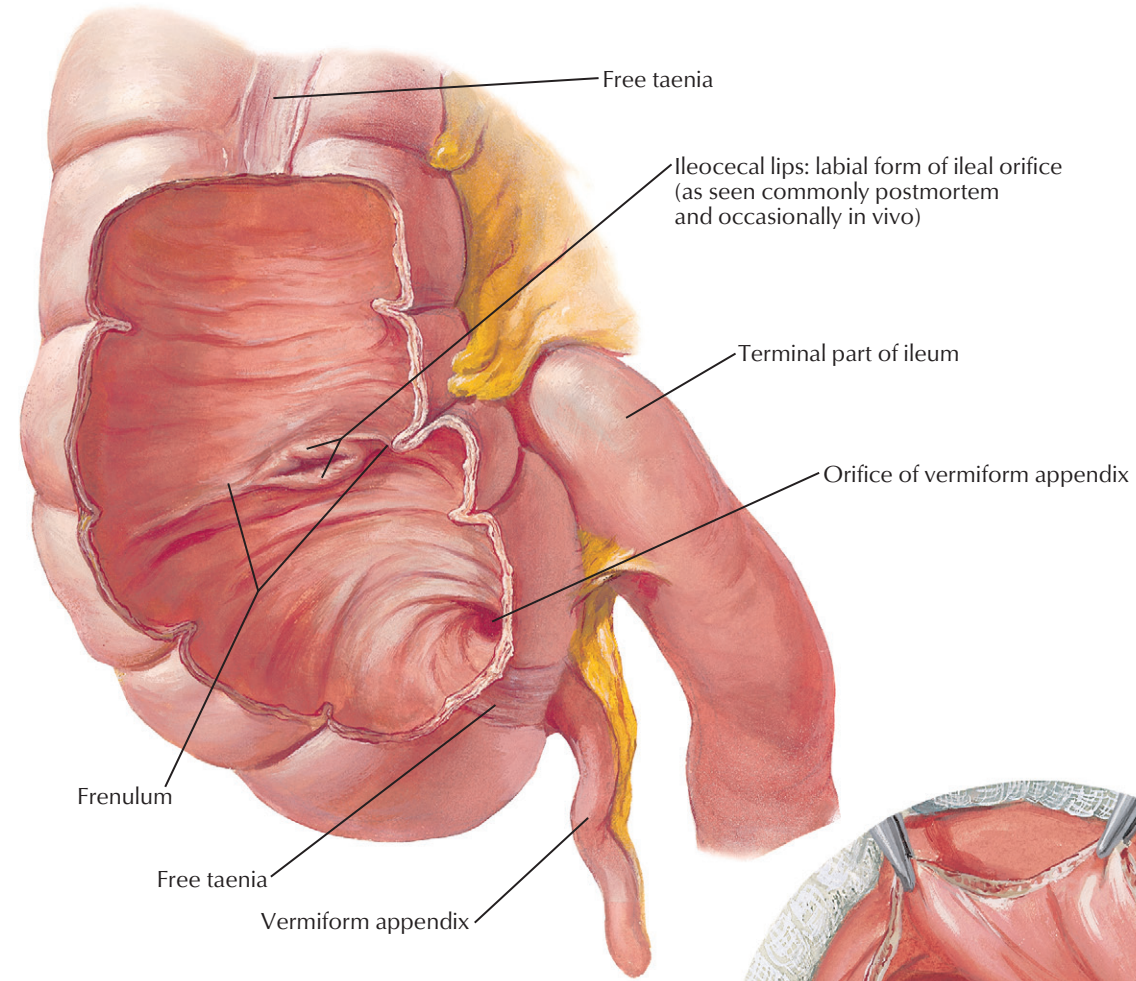
Jejunum

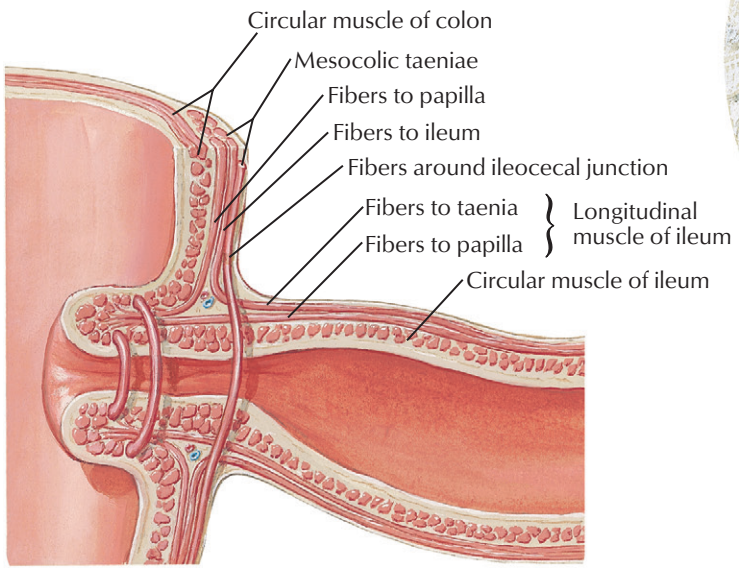


Ileum

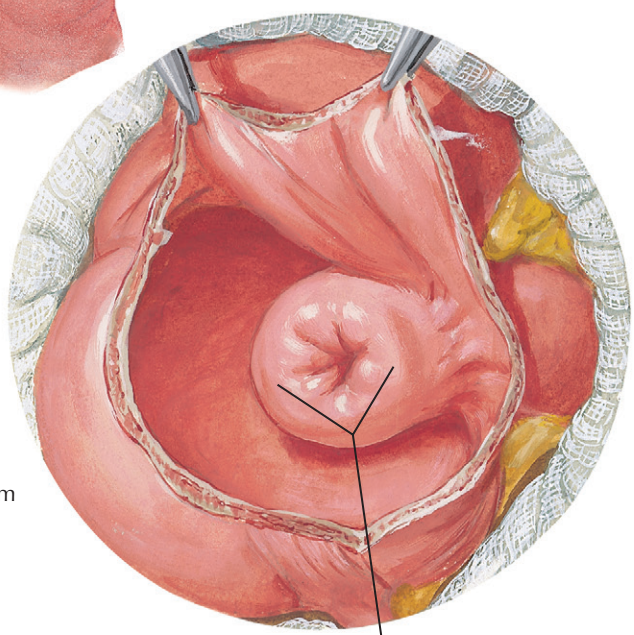


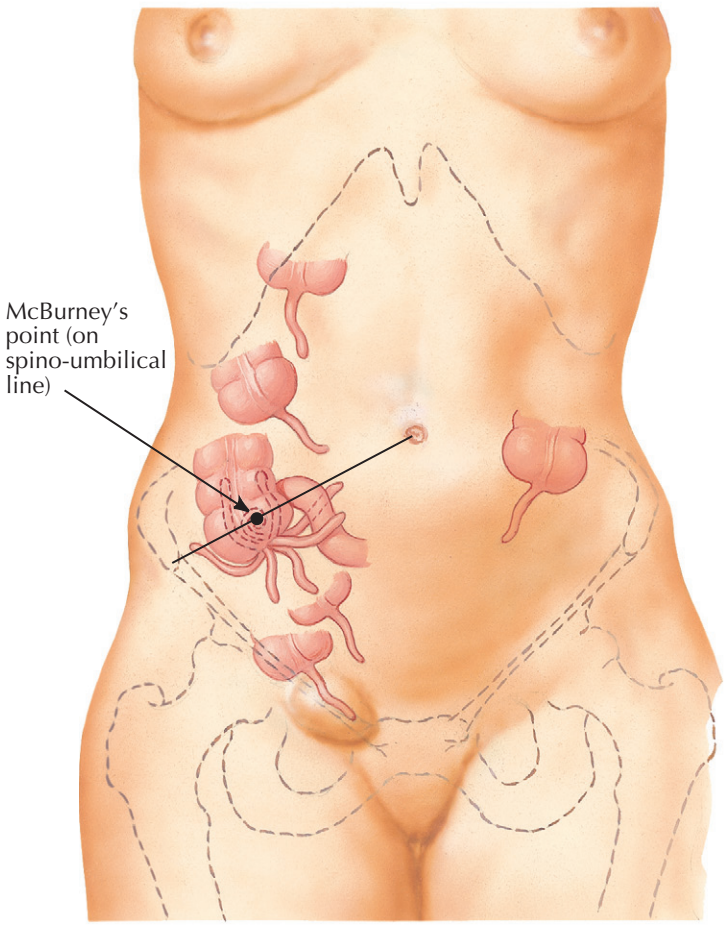

Ileocolic artery
Colic branch
Ileal branch
Superior mesenteric artery
Posterior cecal artery
Appendicular artery
Anterior cecal artery
Vascular fold of cecum
Superior ileocecal recess
Ileocecal fold (bloodless fold of Treves)
Terminal part of ileum
Inferior ileocecal recess
Meso-appendix
Appendicular artery
Vermiform appendix
Cecum
External iliac vessels (retroperitoneal)
Haustra
Retrocecal recess
Cecal folds
Right paracolic gutter
Free taenia
Haustra
Appendicular artery
Omental taenia
Mesocolic taenia
Posterior cecal artery
Cecal folds
Retrocecal recess





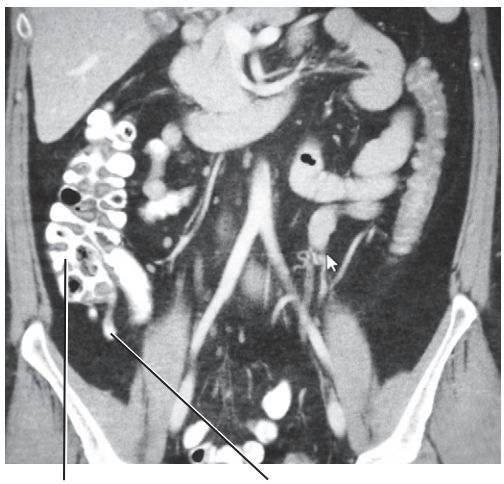
Schema of muscle fibers at ileal orifice

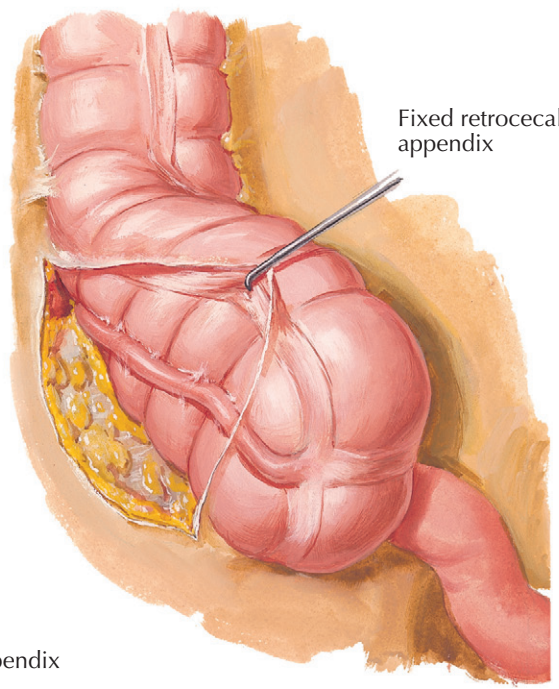


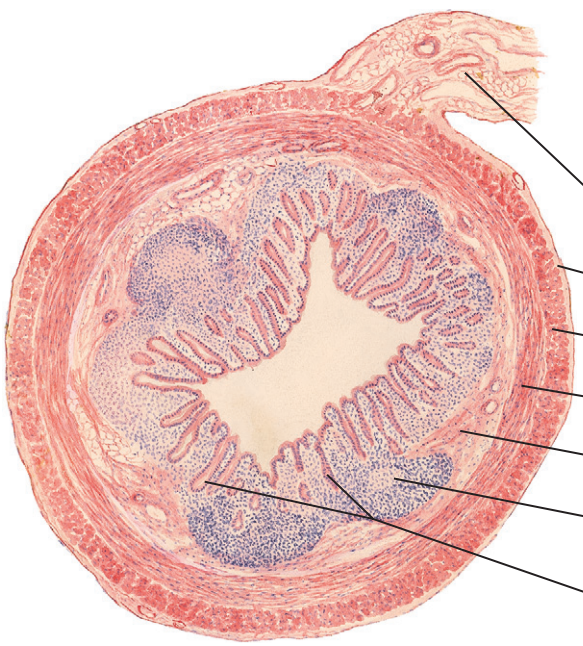


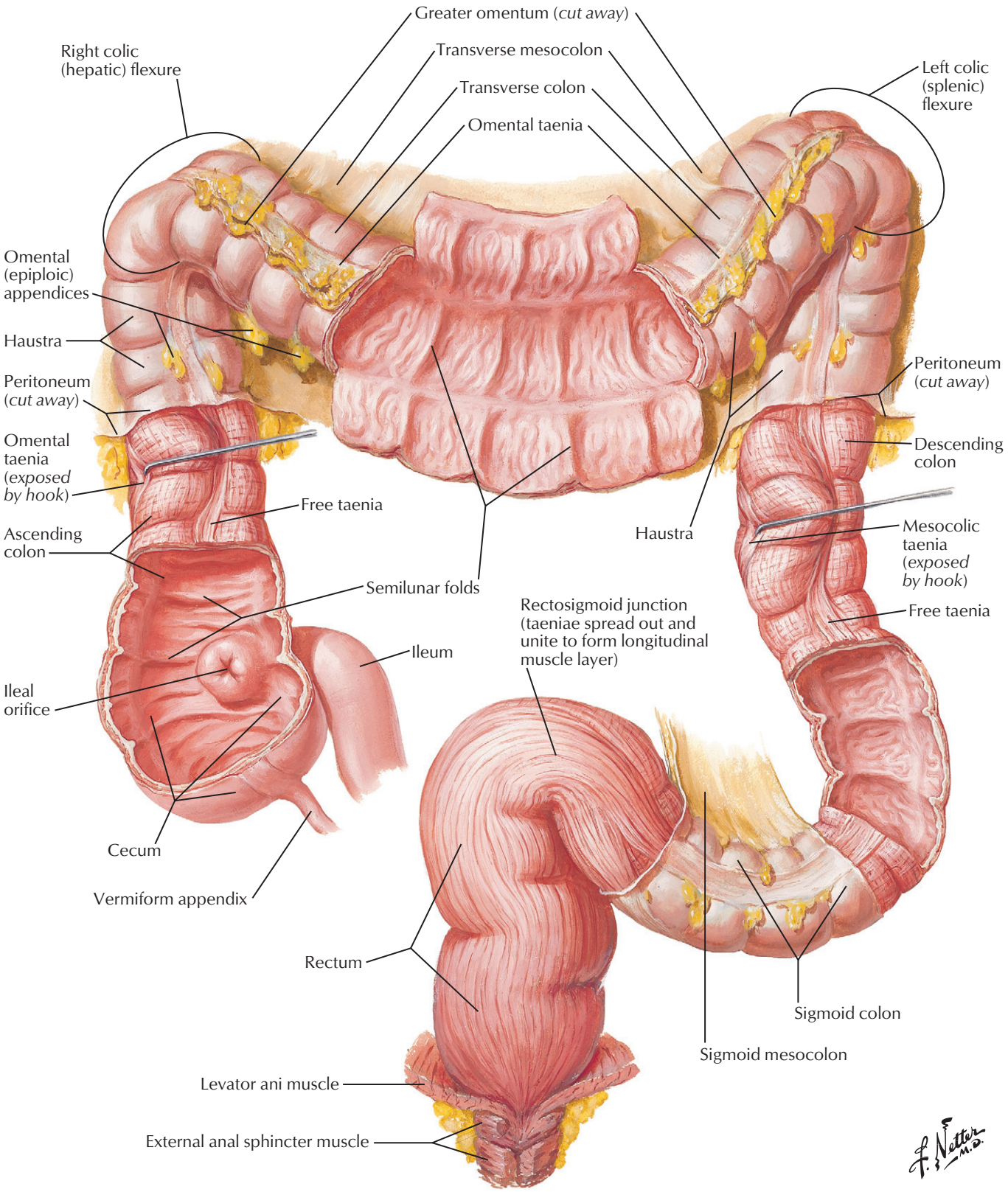
Variations in position of appendix

Coronal CT with contrast



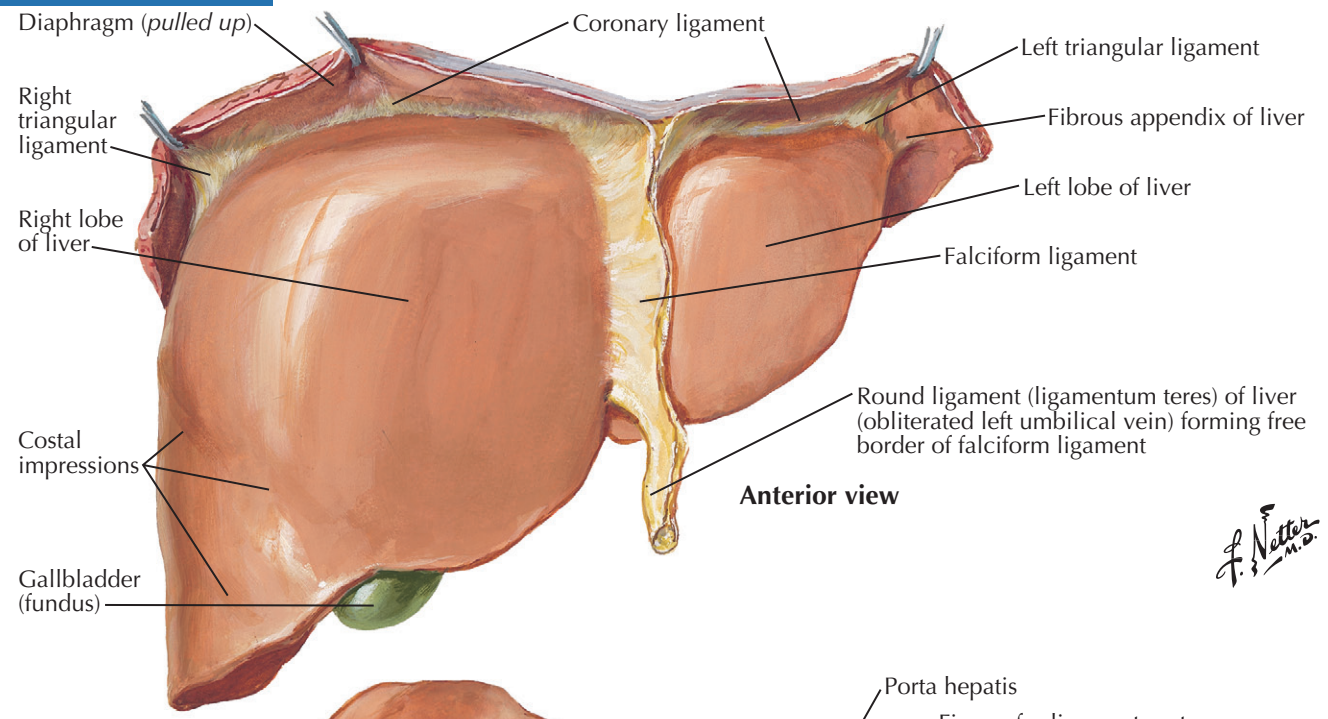




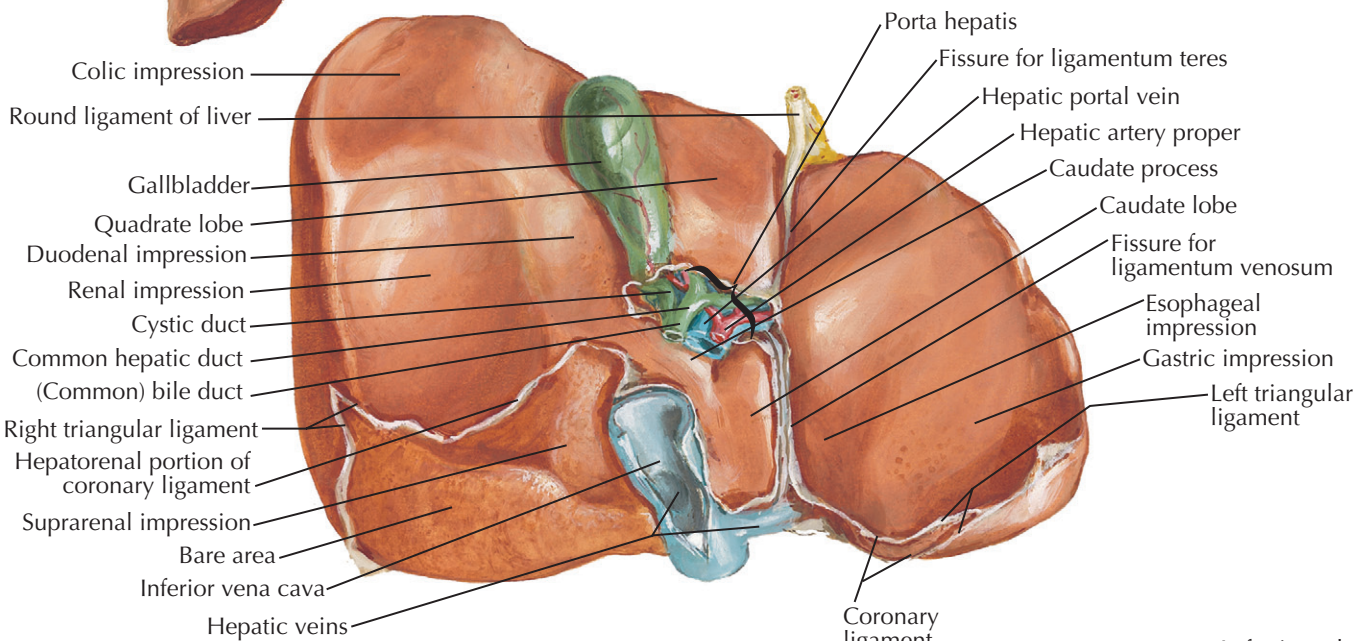

Greater omentum (*cut away*)
Right colic (hepatic) flexure
Transverse mesocolon
Transverse colon
Omental taenia
Left colic (splenic) flexure
Omental (epiploic) appendices
Haustra
Peritoneum (*cut away*)
Omental taenia (*exposed by hook*)
Ascending colon
Free taenia
Semilunar folds
Ileum
Ileal orifice
Cecum
Vermiform appendix
Haustra
Peritoneum (*cut away*)
Descending colon
Mesocolic taenia (*exposed by hook*)
Free taenia
Rectosigmoid junction (taeniae spread out and unite to form longitudinal muscle layer)
Rectum
Levator ani muscle
External anal sphincter muscle
Sigmoid colon
Sigmoid mesocolon
F. Netter M.D.

Surfaces and Bed of Liver

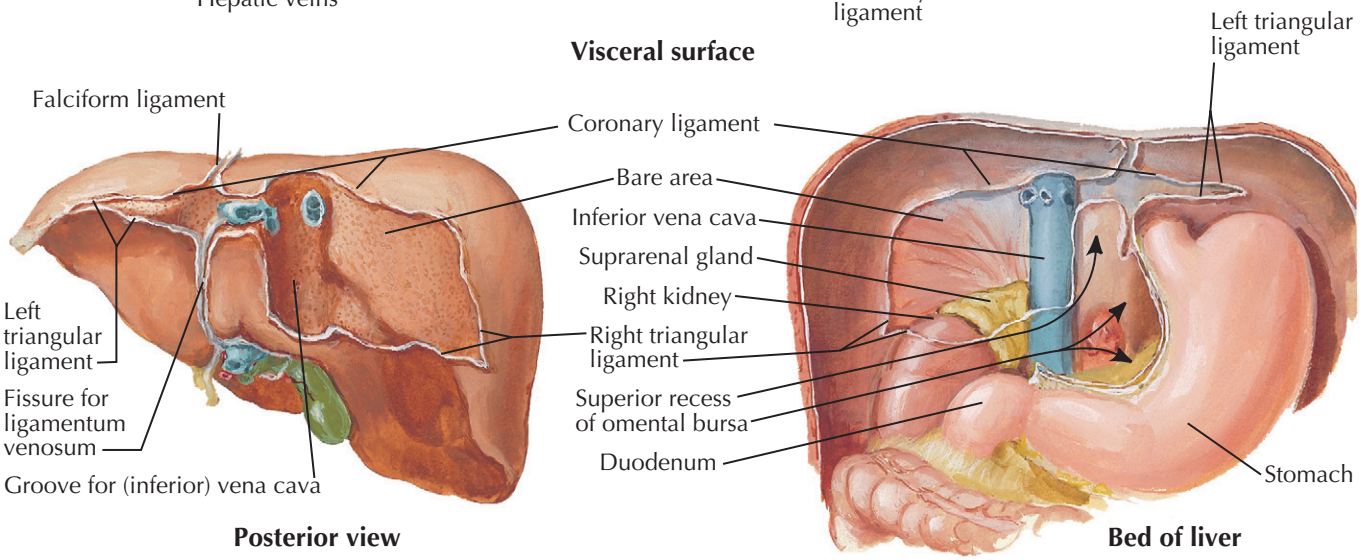
See also Plate 268



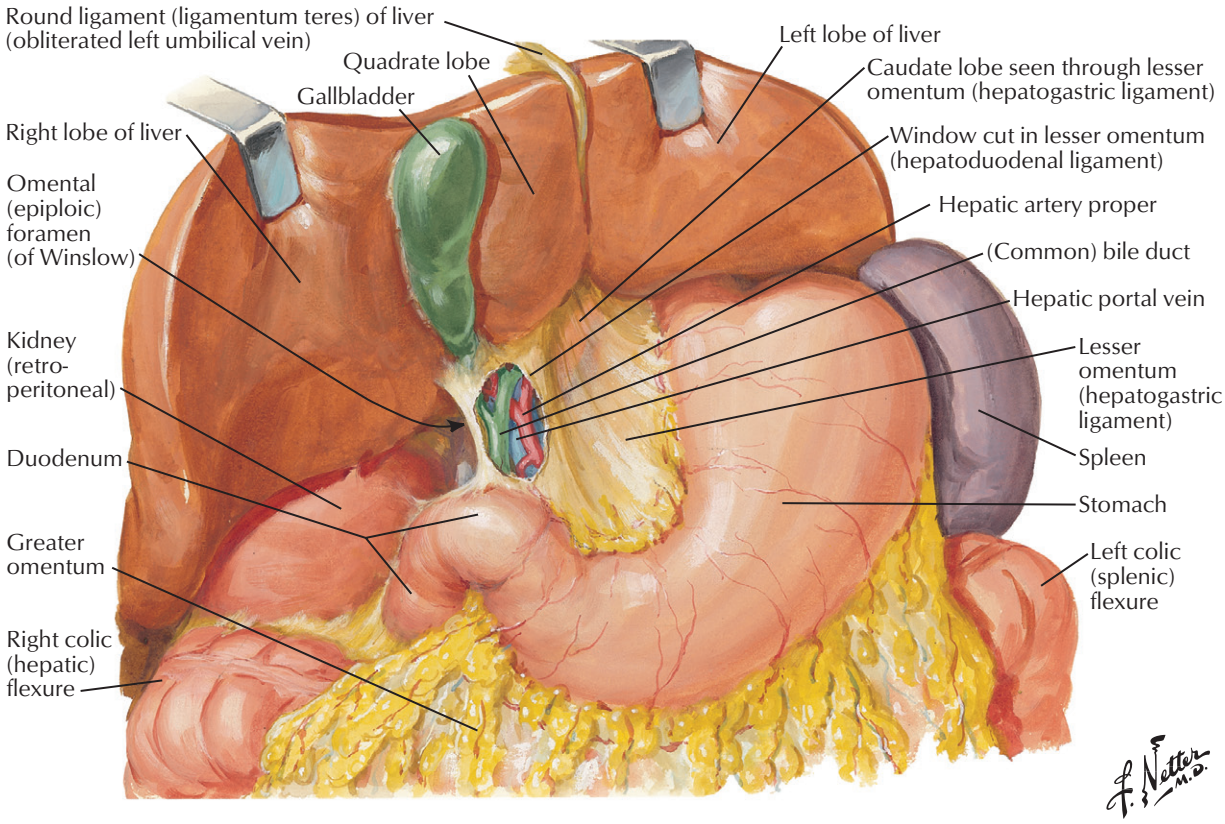
Anterior view

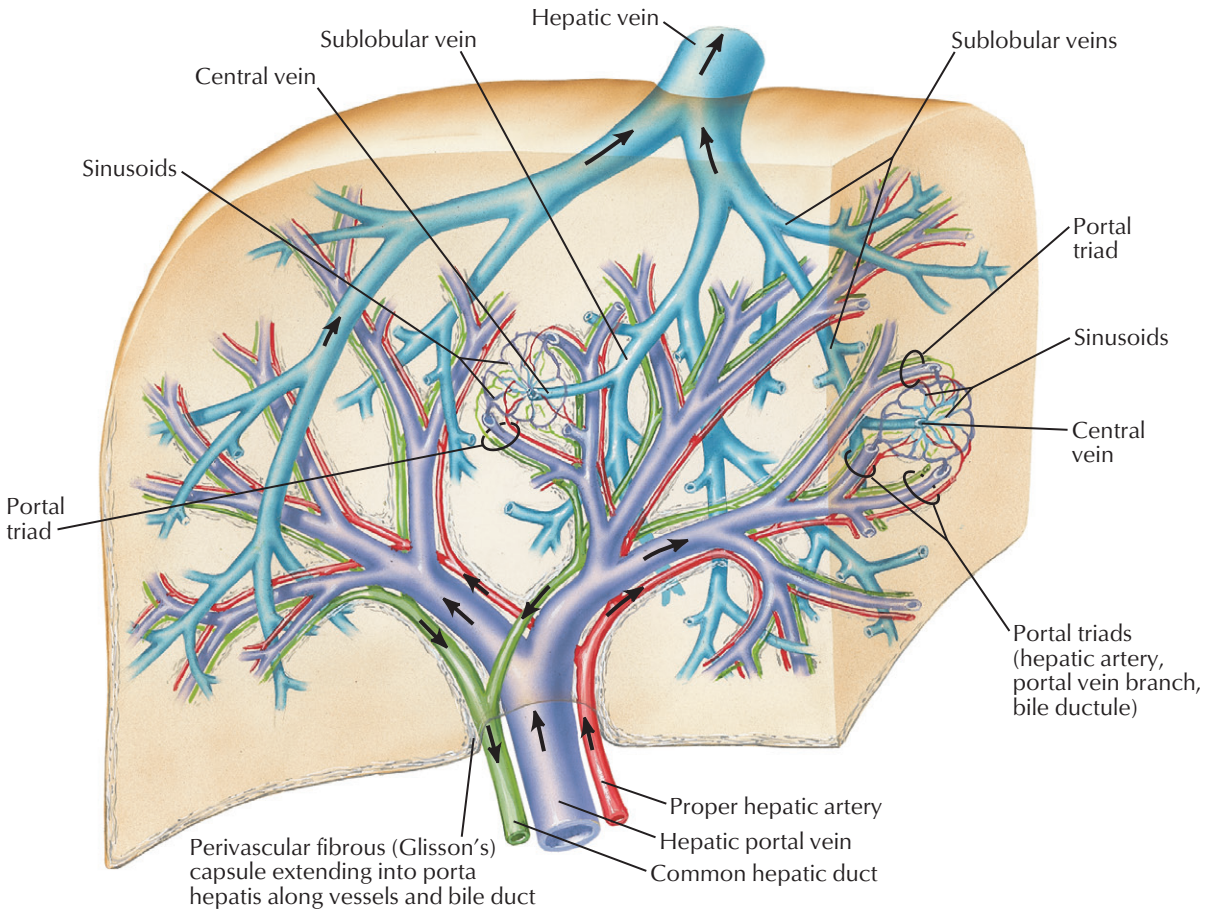


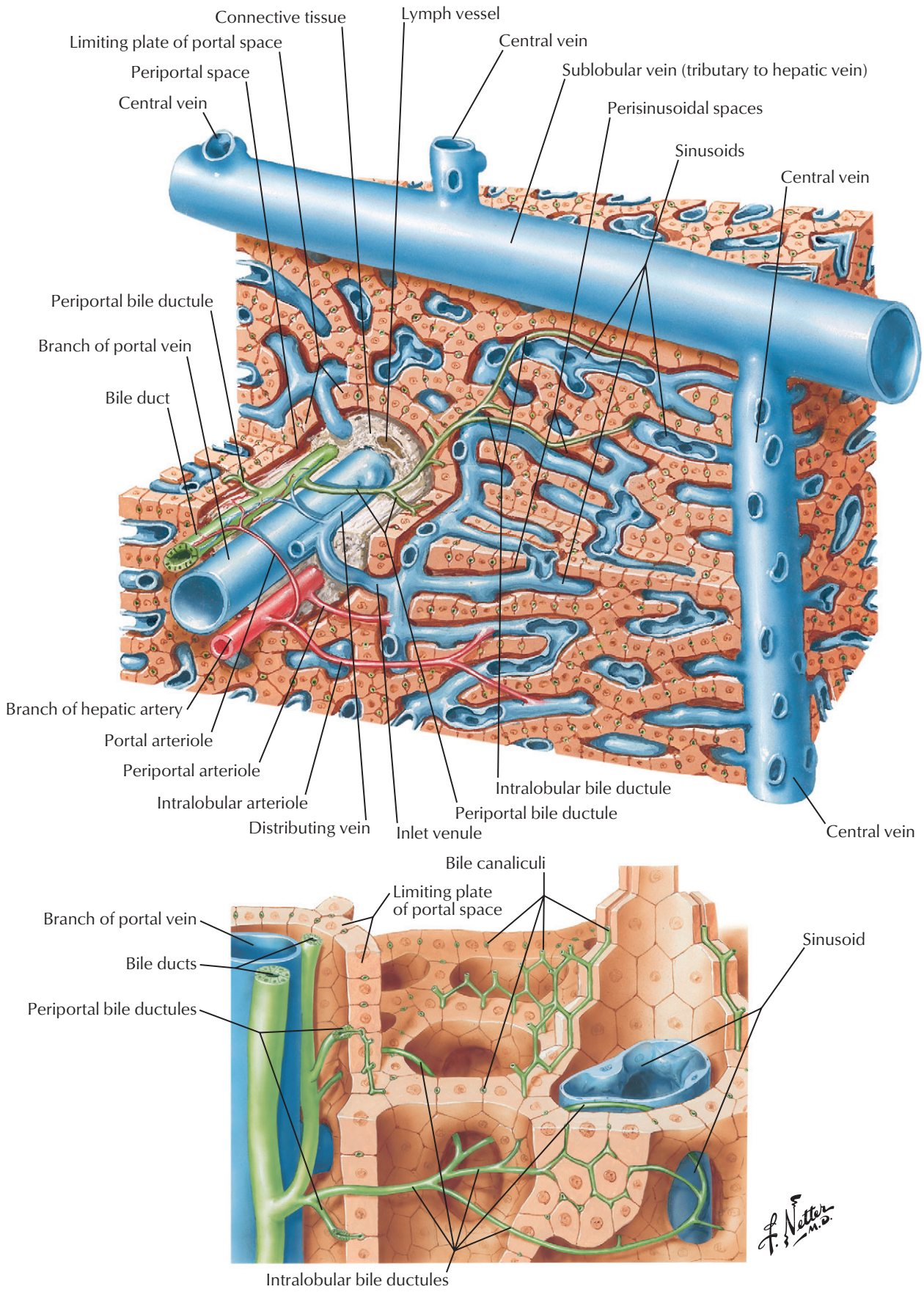
Visceral surface

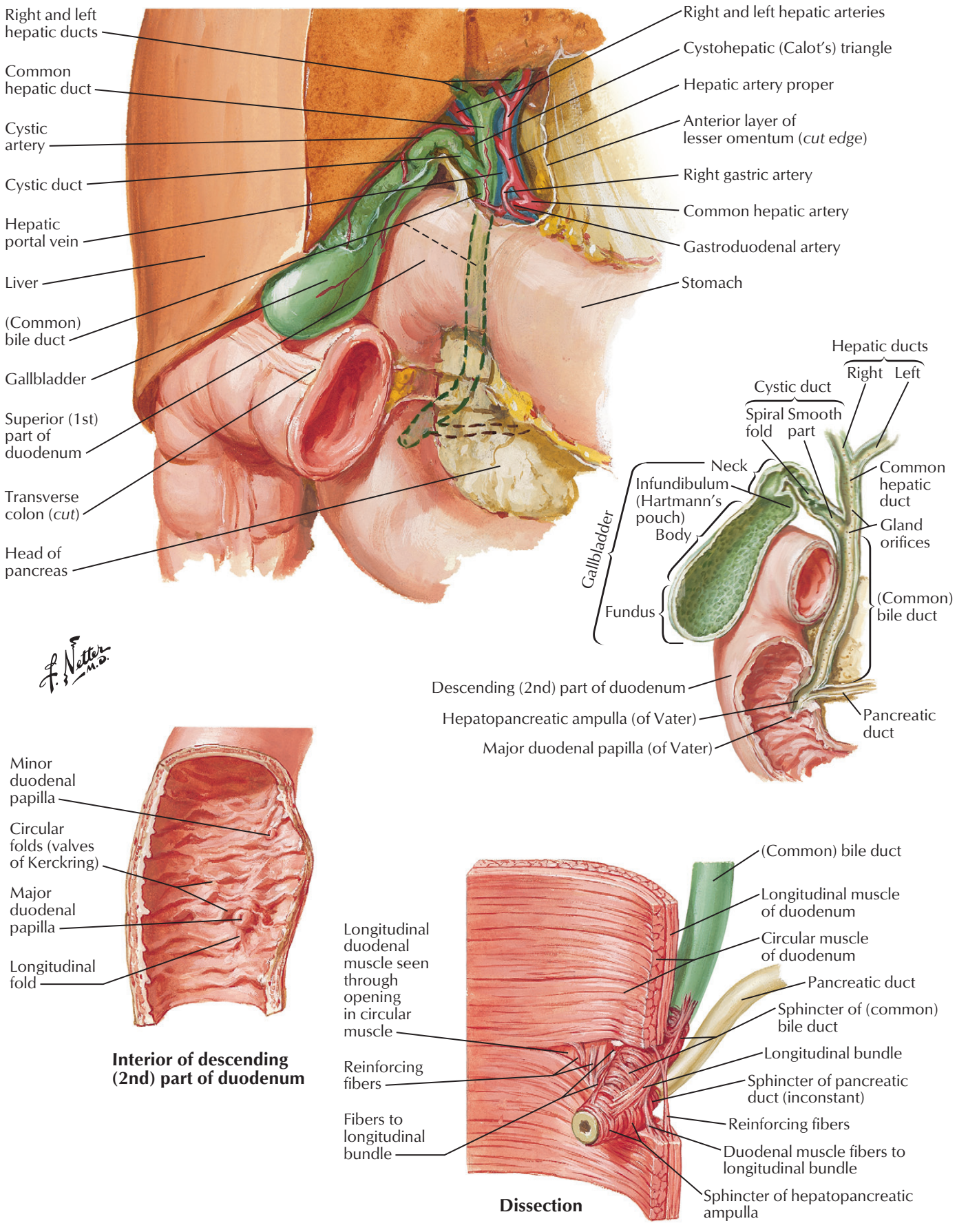


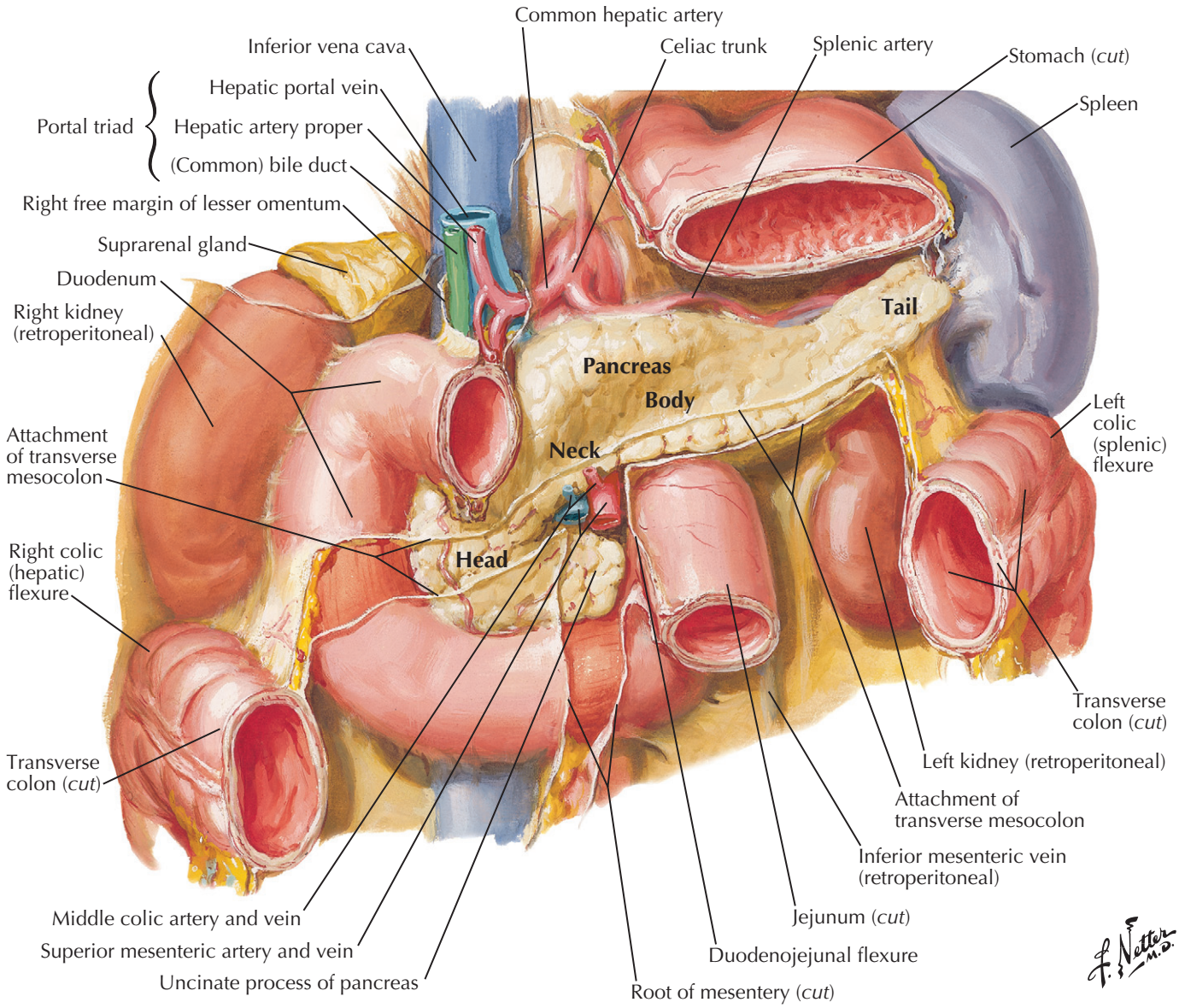
Posterior view **Bed of liver**


Round ligament (ligamentum teres) of liver (obliterated left umbilical vein)
Quadrate lobe
Gallbladder
Right lobe of liver
Omental (epiploic) foramen (of Winslow)
Kidney (retro-peritoneal)
Duodenum
Greater omentum
Right colic (hepatic) flexure
Left lobe of liver
Caudate lobe seen through lesser omentum (hepatogastric ligament)
Window cut in lesser omentum (hepatoduodenal ligament)
Hepatic artery proper
(Common) bile duct
Hepatic portal vein
Lesser omentum (hepatogastric ligament)
Spleen
Stomach
Left colic (splenic) flexure
F. Netter M.D.

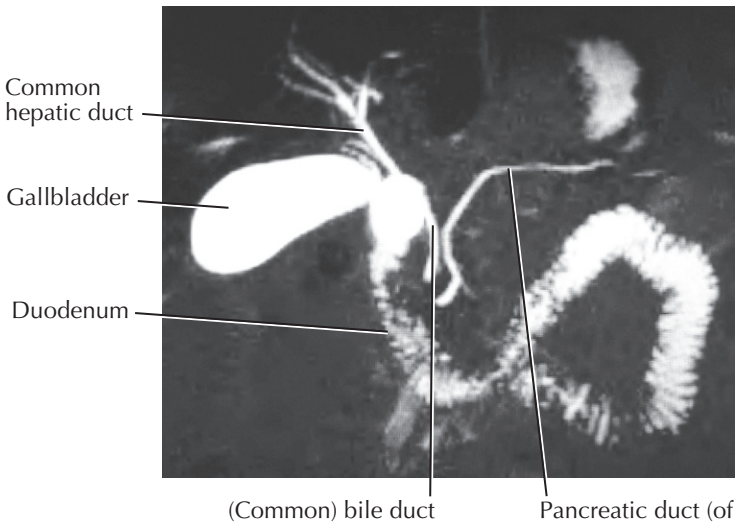

Hepatic vein
Sublobular vein
Central vein
Sinusoids
Portal triad
Sublobular veins
Portal triad
Sinusoids
Central vein
Portal triads (hepatic artery, portal vein branch, bile ductule)
Proper hepatic artery
Hepatic portal vein
Common hepatic duct
Perivascular fibrous (Glisson's) capsule extending into porta hepatis along vessels and bile duct

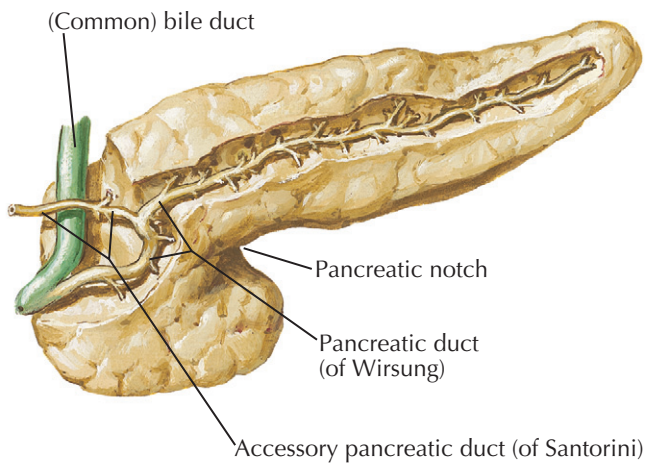

Connective tissue
Lymph vessel
Limiting plate of portal space
Central vein
Periportal space
Sublobular vein (tributary to hepatic vein)
Central vein
Perisinusoidal spaces
Sinusoids
Central vein
Periportal bile ductule
Branch of portal vein
Bile duct
Branch of hepatic artery
Portal arteriole
Periportal arteriole
Intralobular arteriole
Distributing vein
Inlet venule
Intralobular bile ductule
Periportal bile ductule
Central vein
Bile canaliculi
Limiting plate of portal space
Branch of portal vein
Bile ducts
Periportal bile ductules
Sinusoid
Intralobular bile ductules

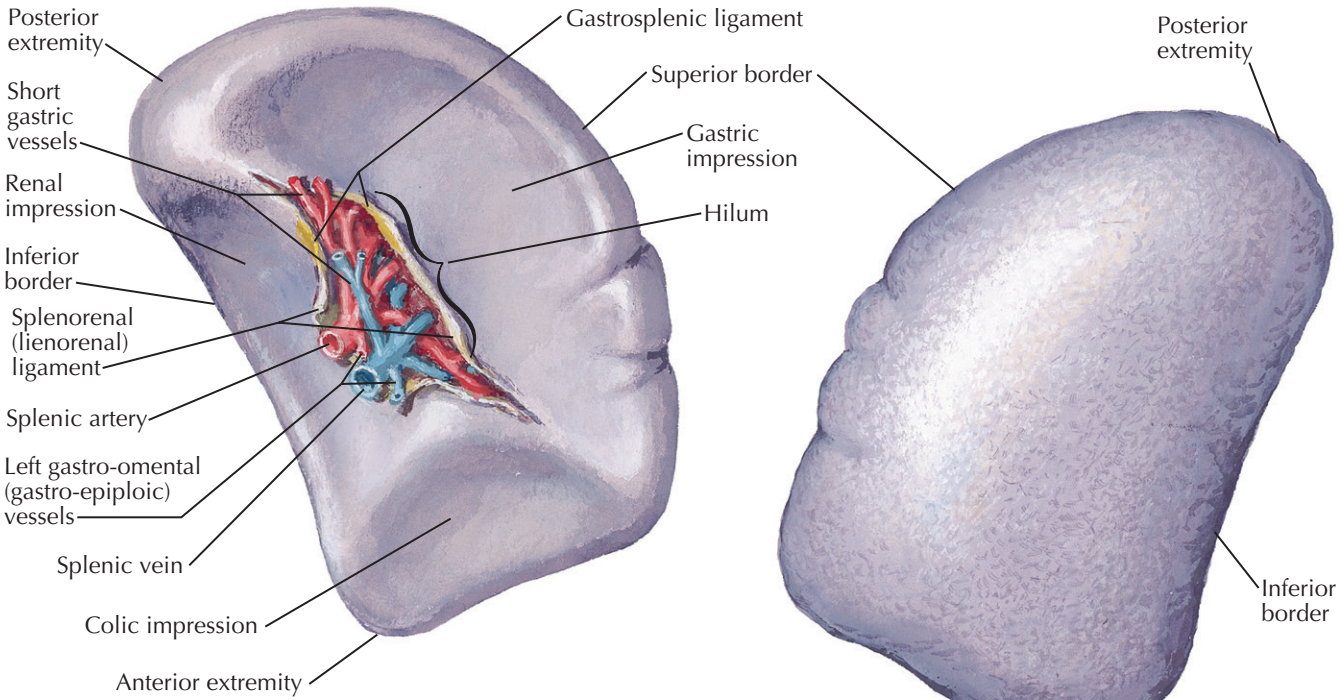

Right and left hepatic ducts
Common hepatic duct
Cystic artery
Cystic duct
Hepatic portal vein
Liver
(Common) bile duct
Gallbladder
Superior (1st) part of duodenum
Transverse colon (cut)
Head of pancreas
Right and left hepatic arteries
Cystohepatic (Calot's) triangle
Hepatic artery proper
Anterior layer of lesser omentum (cut edge)
Right gastric artery
Common hepatic artery
Gastroduodenal artery
Stomach
Hepatic ducts
Right
Left
Cystic duct
Spiral fold
Smooth part
Neck
Infundibulum (Hartmann's pouch)
Body
Fundus
Gallbladder
Common hepatic duct
Gland orifices
(Common) bile duct
Descending (2nd) part of duodenum
Hepatopancreatic ampulla (of Vater)
Major duodenal papilla (of Vater)
Pancreatic duct
Minor duodenal papilla
Circular folds (valves of Kerckring)
Major duodenal papilla
Longitudinal fold
Interior of descending (2nd) part of duodenum
Longitudinal duodenal muscle seen through opening in circular muscle
Reinforcing fibers
Fibers to longitudinal bundle
(Common) bile duct
Longitudinal muscle of duodenum
Circular muscle of duodenum
Pancreatic duct
Sphincter of (common) bile duct
Longitudinal bundle
Sphincter of pancreatic duct (inconstant)
Reinforcing fibers
Duodenal muscle fibers to longitudinal bundle
Sphincter of hepatopancreatic ampulla
Dissection

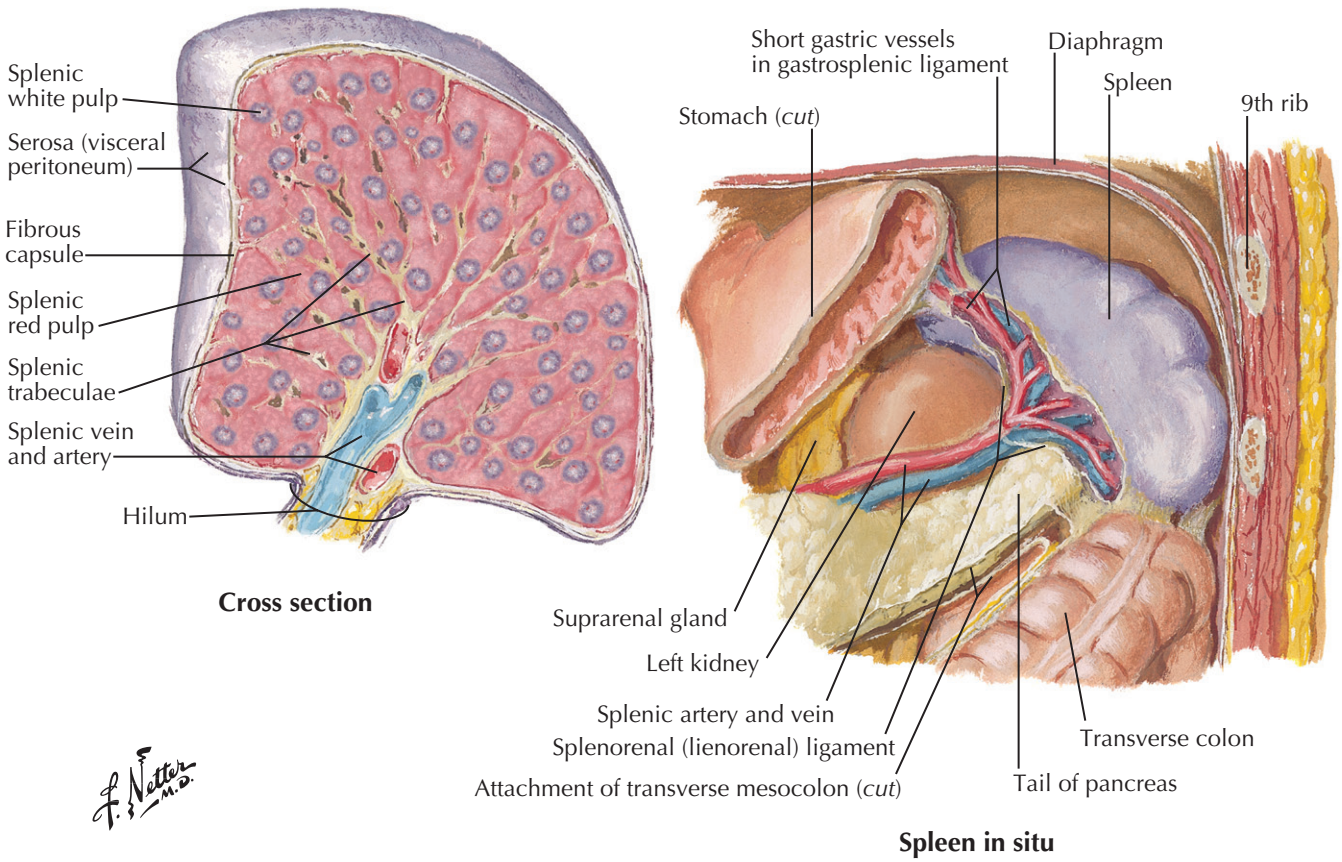


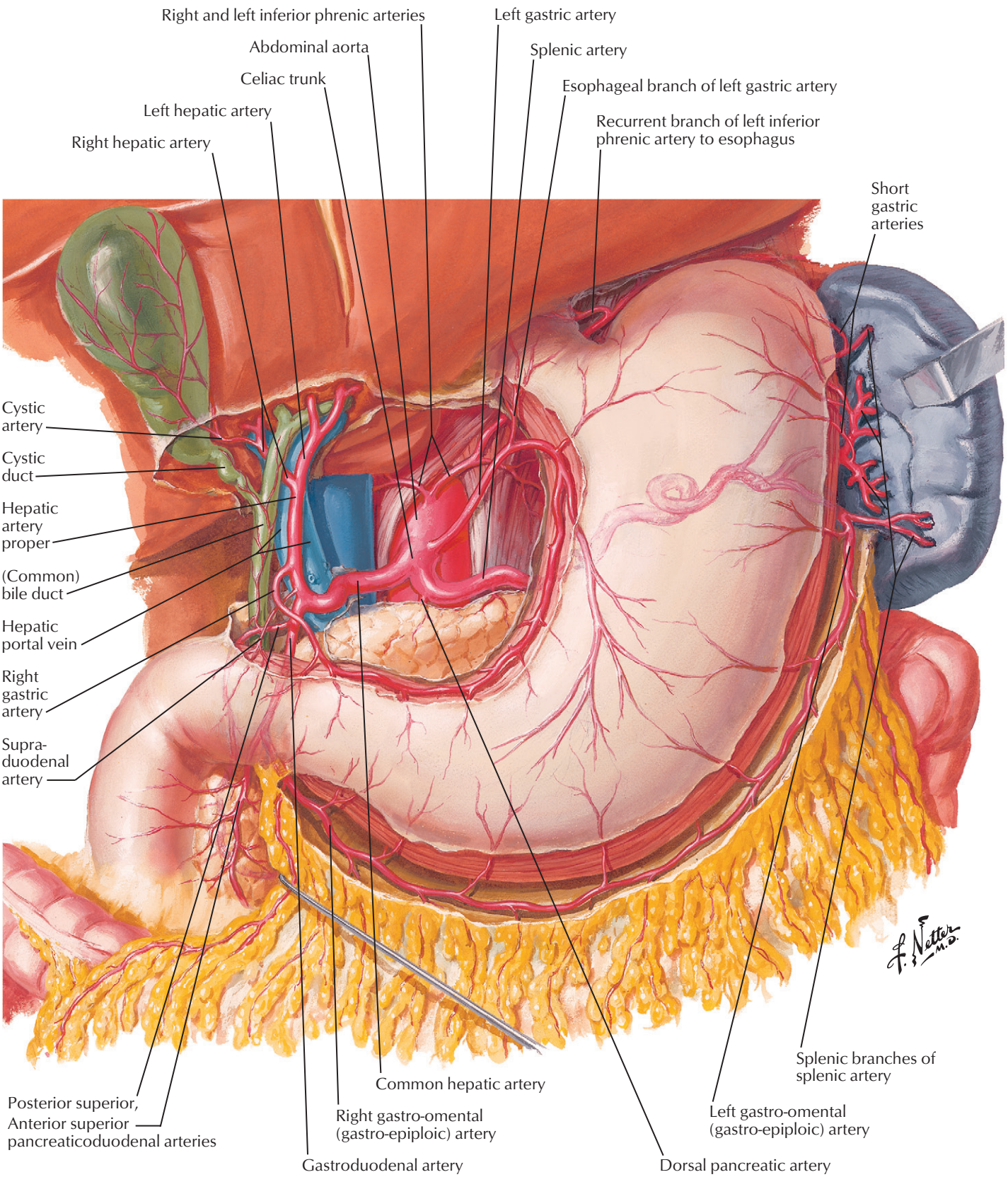
Magnetic resonance cholangiopancreatography (MRCP)

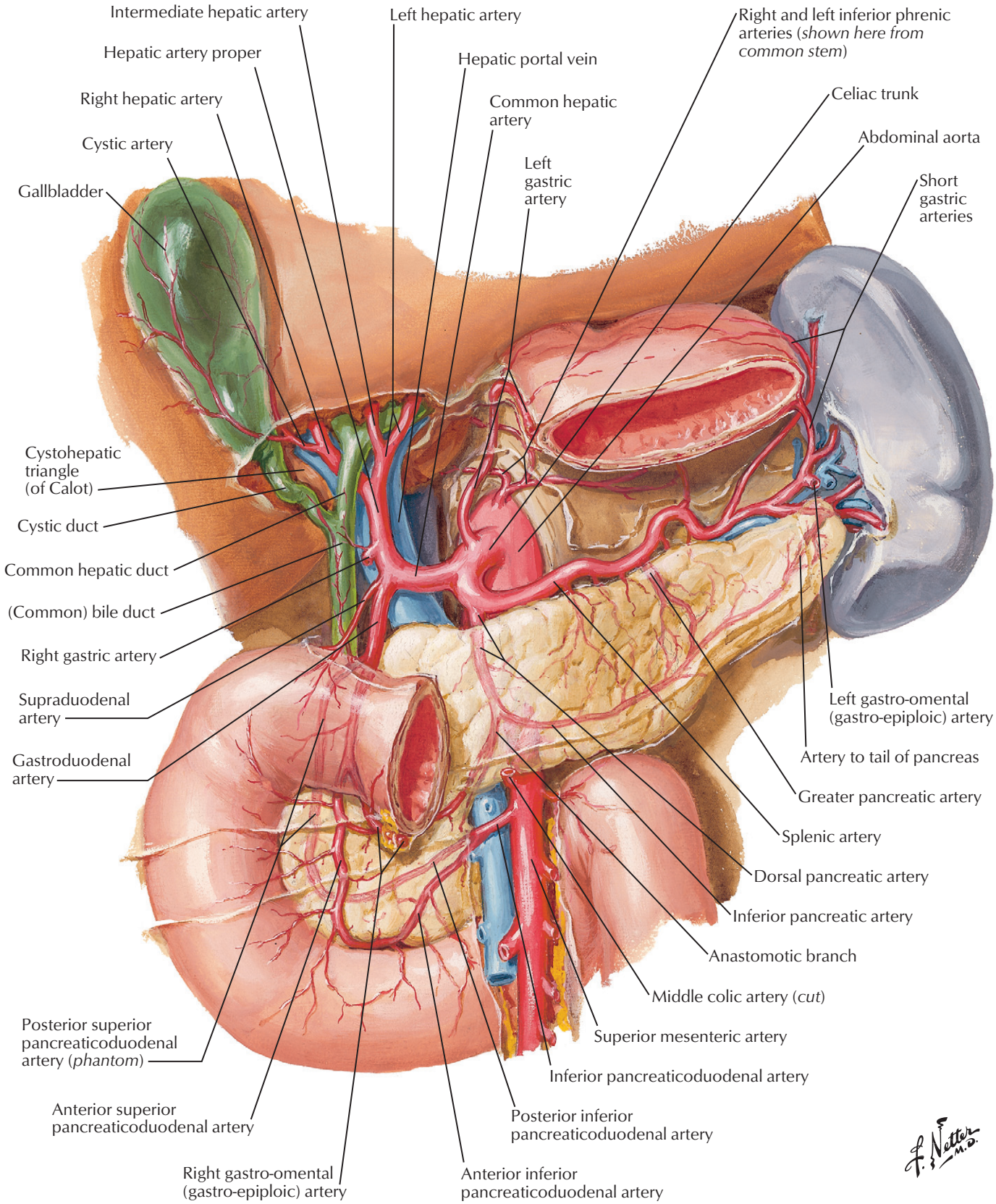





Posterior extremity
Short gastric vessels
Renal impression
Inferior border
Splenorenal (lienorenal) ligament
Splenic artery
Left gastro-omental (gastro-epiploic) vessels
Splenic vein
Colic impression
Anterior extremity
Gastrosplenic ligament
Superior border
Gastric impression
Hilum
Visceral surface
Posterior extremity
Inferior border
Anterior extremity
Diaphragmatic surface

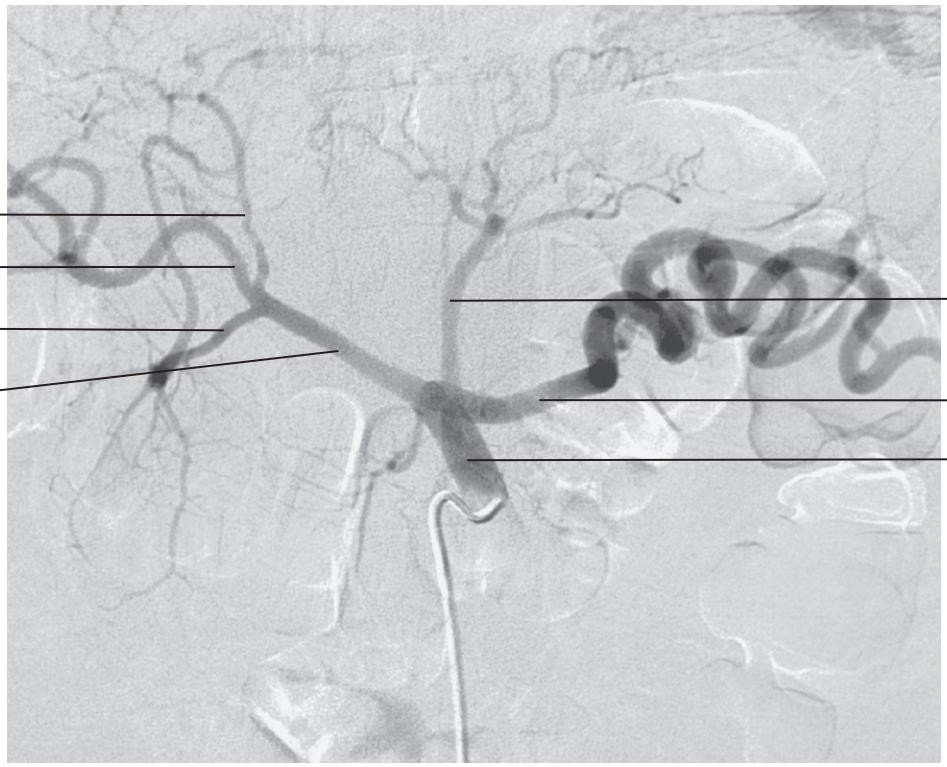

Splenic white pulp
Serosa (visceral peritoneum)
Fibrous capsule
Splenic red pulp
Splenic trabeculae
Splenic vein and artery
Hilum
Cross section
Short gastric vessels in gastrosplenic ligament
Diaphragm
Spleen
9th rib
Stomach (cut)
Suprarenal gland
Left kidney
Splenic artery and vein
Splenorenal (lienorenal) ligament
Attachment of transverse mesocolon (cut)
Transverse colon
Tail of pancreas
Spleen in situ


Right and left inferior phrenic arteries
Abdominal aorta
Celiac trunk
Left hepatic artery
Right hepatic artery
Left gastric artery
Splenic artery
Esophageal branch of left gastric artery
Recurrent branch of left inferior phrenic artery to esophagus
Short gastric arteries
Cystic artery
Cystic duct
Hepatic artery proper
(Common) bile duct
Hepatic portal vein
Right gastric artery
Supra-duodenal artery
Posterior superior, Anterior superior pancreaticoduodenal arteries
Gastroduodenal artery
Common hepatic artery
Right gastro-omental (gastro-epiploic) artery
Dorsal pancreatic artery
Left gastro-omental (gastro-epiploic) artery
Splenic branches of splenic artery


Intermediate hepatic artery
Left hepatic artery
Right and left inferior phrenic arteries (*shown here from common stem*)
Hepatic artery proper
Hepatic portal vein
Right hepatic artery
Common hepatic artery
Celiac trunk
Cystic artery
Abdominal aorta
Left gastric artery
Gallbladder
Short gastric arteries
Cystohepatic triangle (of Calot)
Cystic duct
Common hepatic duct
(Common) bile duct
Right gastric artery
Supraduodenal artery
Gastroduodenal artery
Left gastro-omental (gastro-epiploic) artery
Artery to tail of pancreas
Greater pancreatic artery
Splenic artery
Dorsal pancreatic artery
Inferior pancreatic artery
Anastomotic branch
Middle colic artery (*cut*)
Posterior superior pancreaticoduodenal artery (*phantom*)
Superior mesenteric artery
Inferior pancreaticoduodenal artery
Anterior superior pancreaticoduodenal artery
Posterior inferior pancreaticoduodenal artery
Right gastro-omental (gastro-epiploic) artery
Anterior inferior pancreaticoduodenal artery

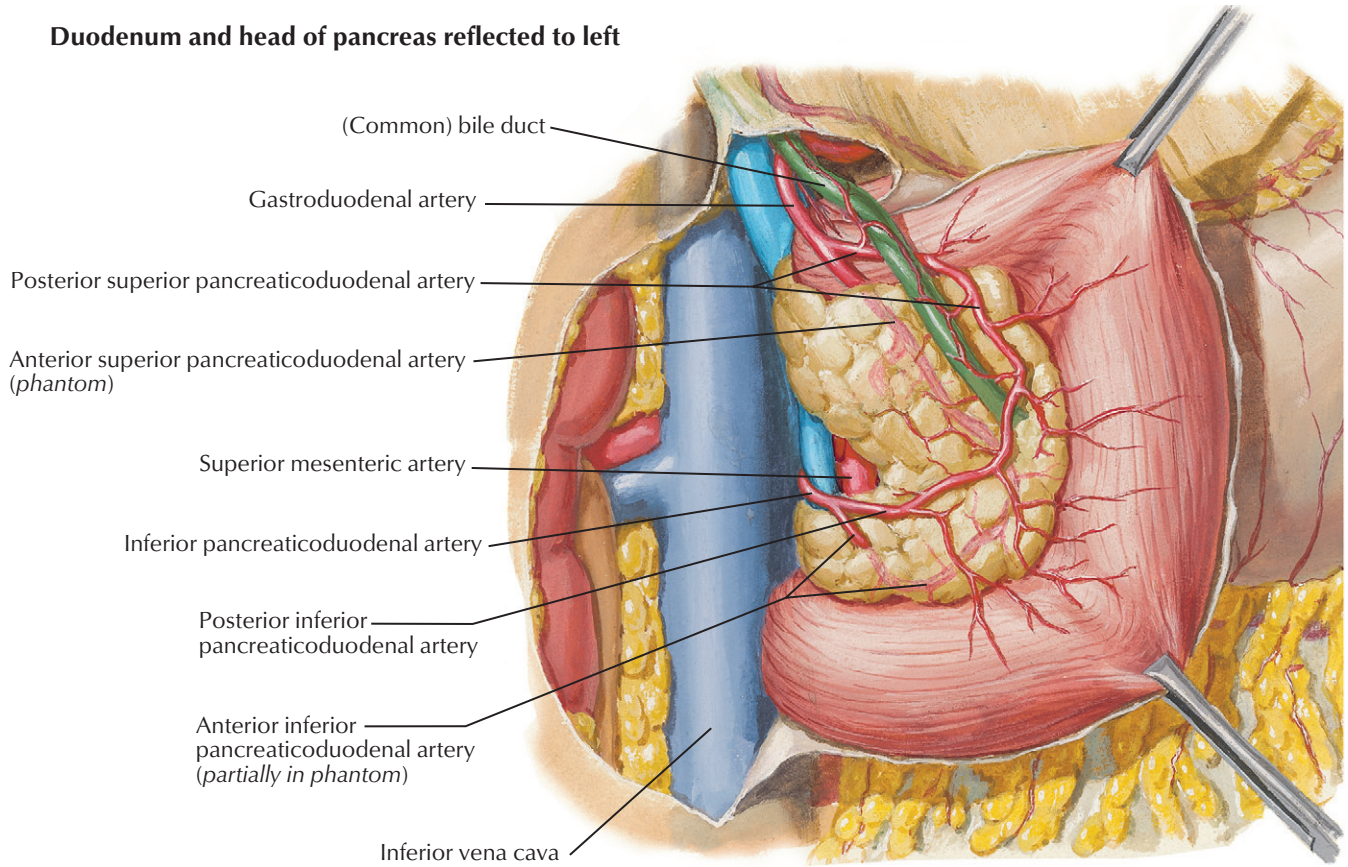
Celiac Arteriogram and CT Angiogram

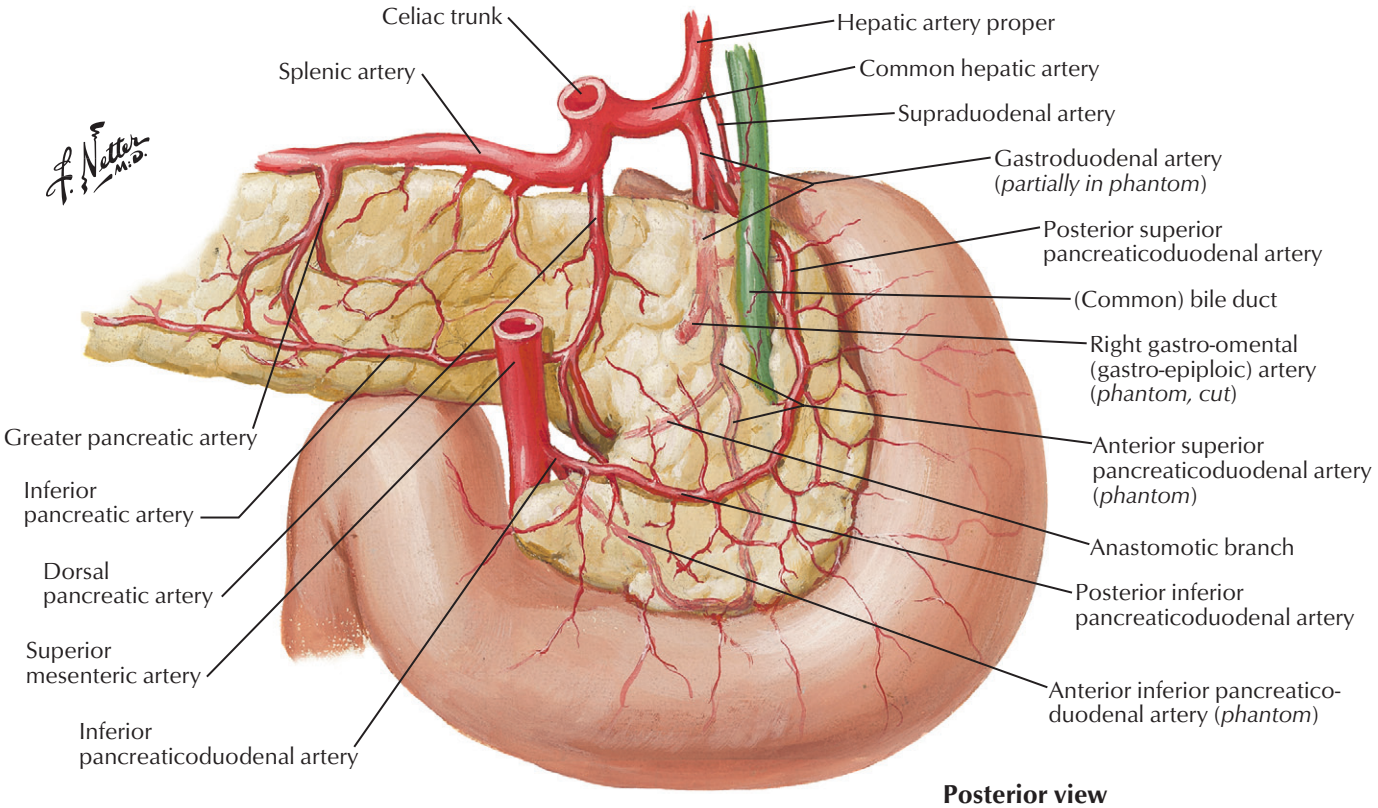
See also Plates 283, 284



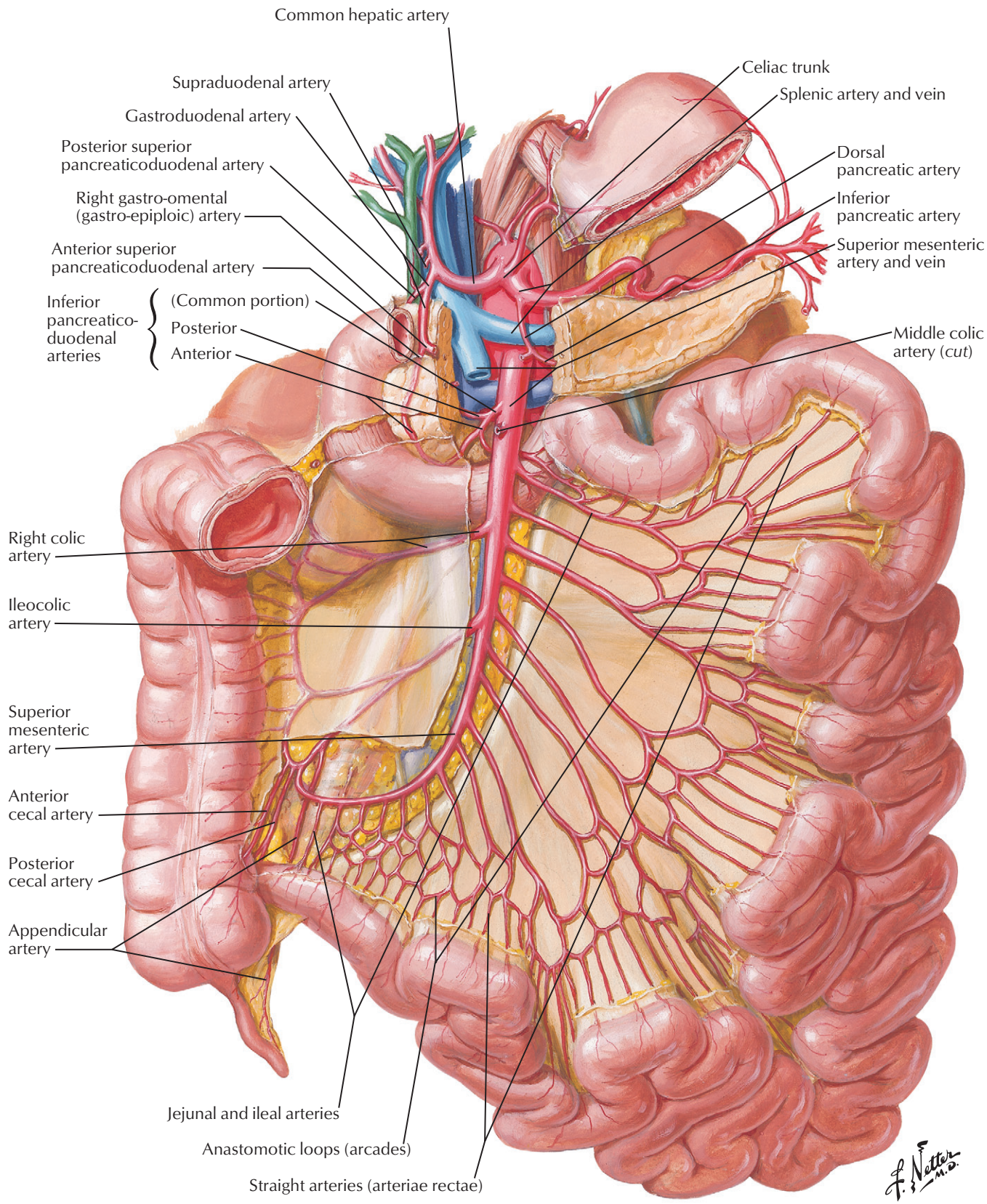


Duodenum and head of pancreas reflected to left



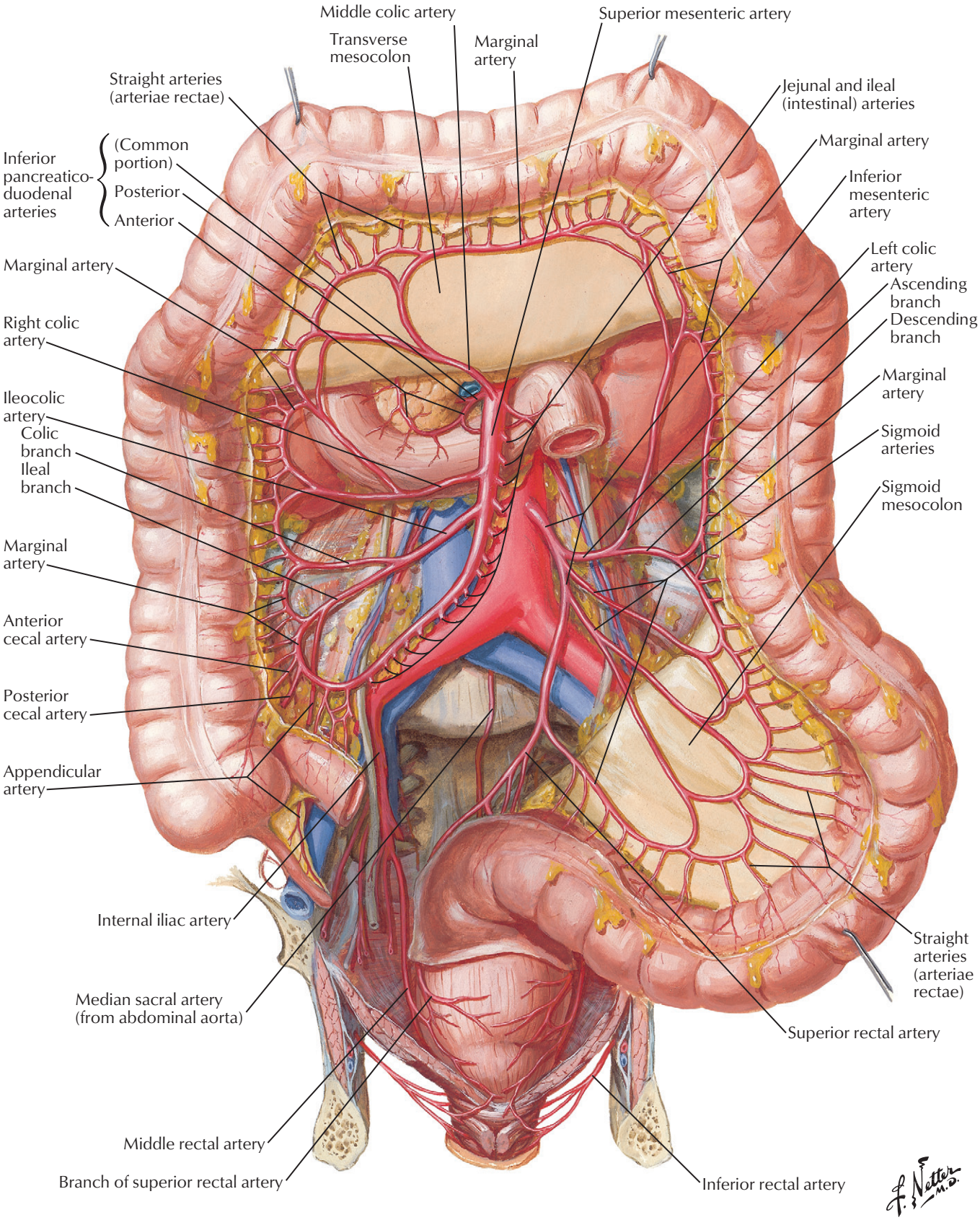


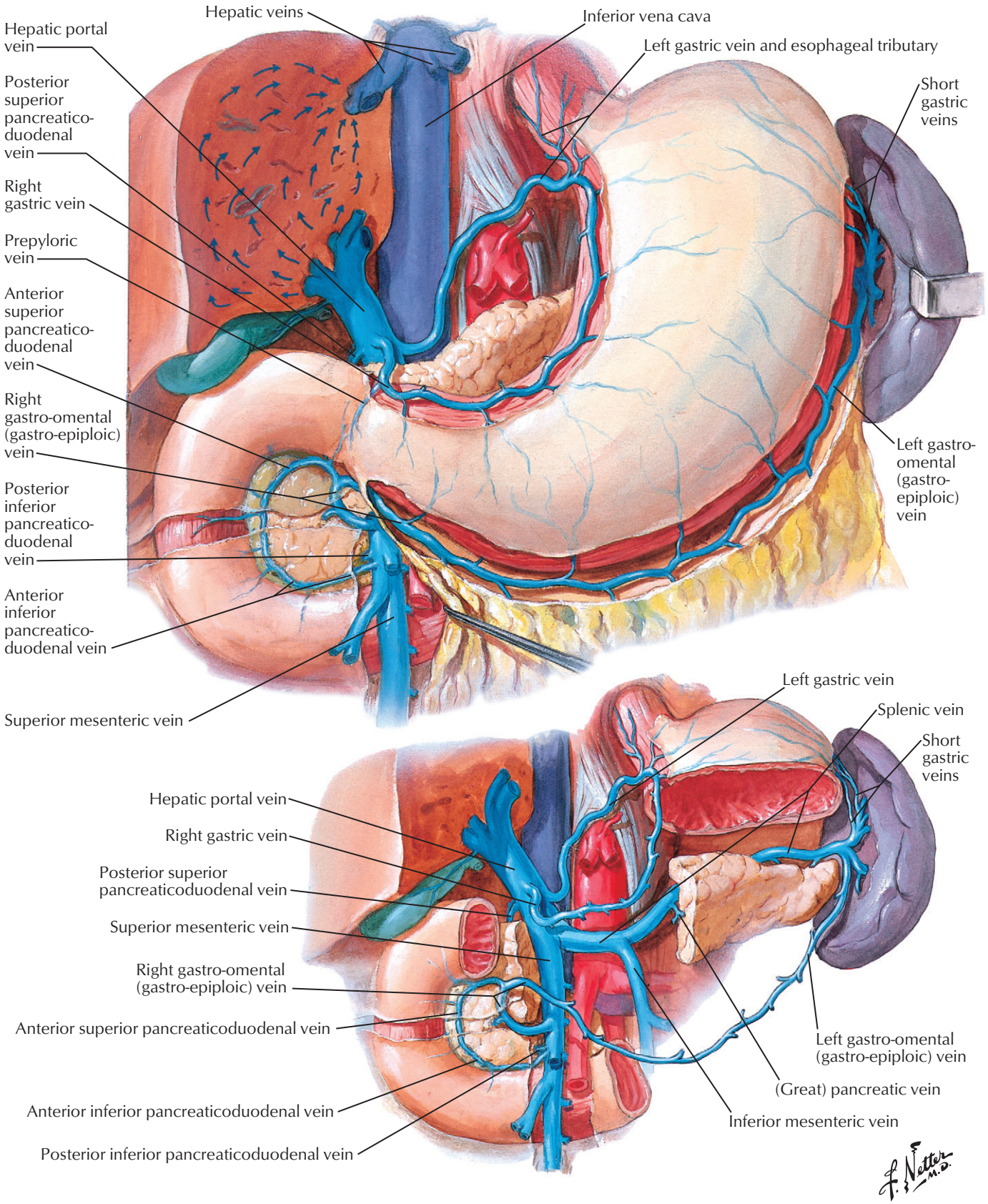
Posterior view

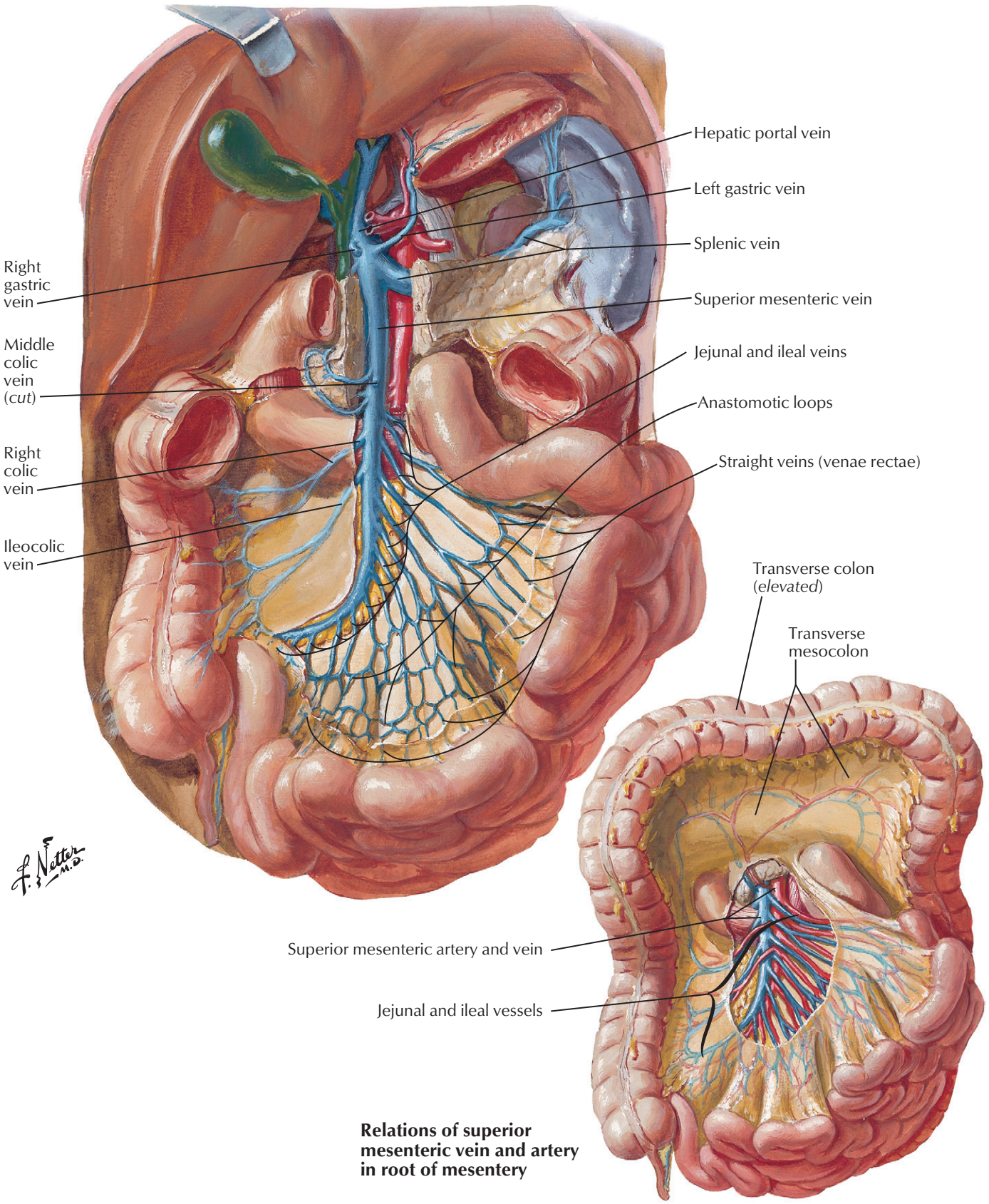

Common hepatic artery
Supraduodenal artery
Gastroduodenal artery
Posterior superior pancreaticoduodenal artery
Right gastro-omental (gastro-epiploic) artery
Anterior superior pancreaticoduodenal artery
Inferior pancreatico-duodenal arteries
(Common portion)
Posterior
Anterior
Celiac trunk
Splenic artery and vein
Dorsal pancreatic artery
Inferior pancreatic artery
Superior mesenteric artery and vein
Middle colic artery (cut)
Right colic artery
Ileocolic artery
Superior mesenteric artery
Anterior cecal artery
Posterior cecal artery
Appendicular artery
Jejunal and ileal arteries
Anastomotic loops (arcades)
Straight arteries (arteriae rectae)

Arteries of Large Intestine

For arteries of rectum see also Plate 317



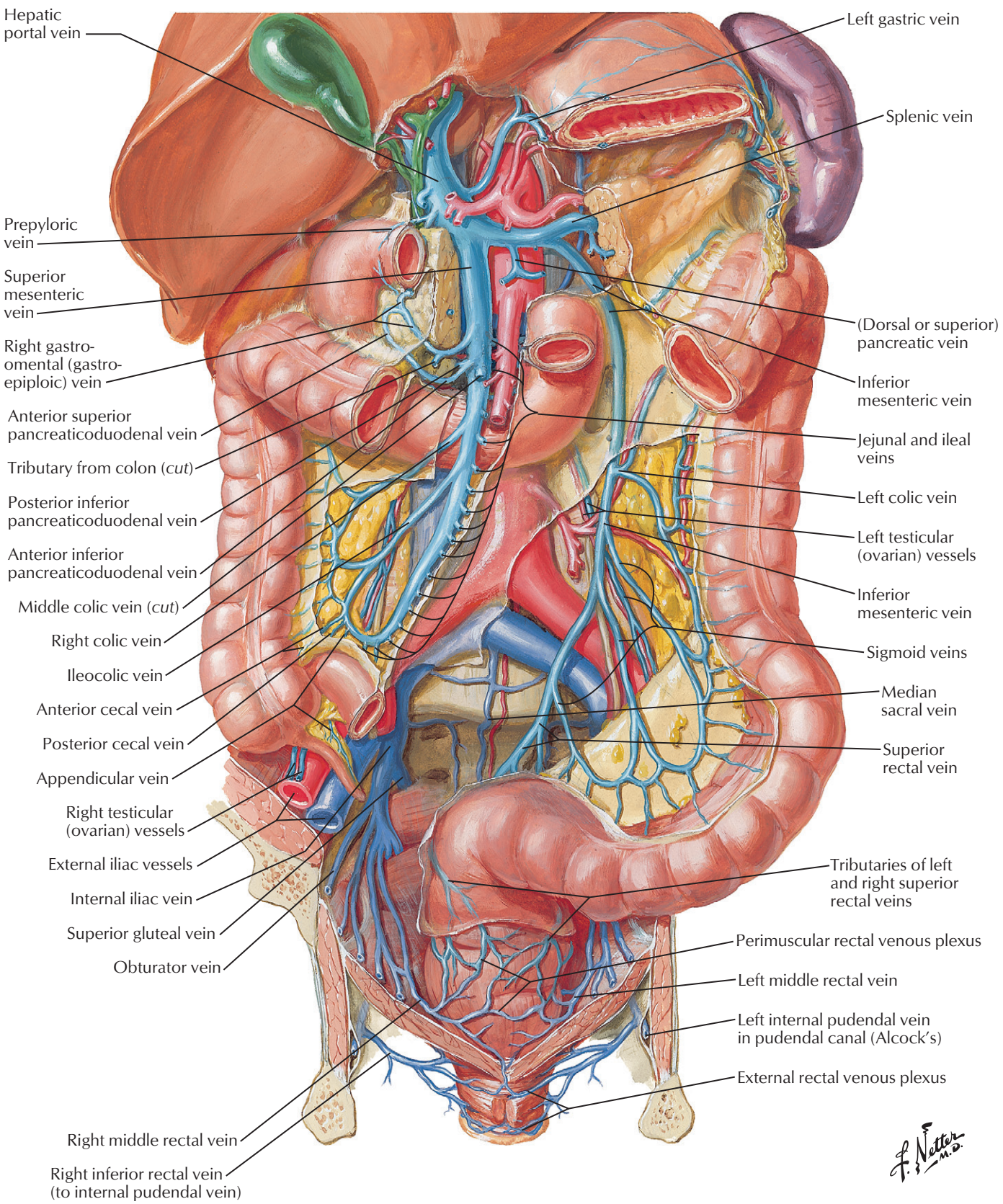

Hepatic veins
Inferior vena cava
Hepatic portal vein
Left gastric vein and esophageal tributary
Posterior superior pancreatico-duodenal vein
Short gastric veins
Right gastric vein
Prepyloric vein
Anterior superior pancreatico-duodenal vein
Right gastro-omental (gastro-epiploic) vein
Left gastro-omental (gastro-epiploic) vein
Posterior inferior pancreatico-duodenal vein
Anterior inferior pancreatico-duodenal vein
Superior mesenteric vein
Left gastric vein
Splenic vein
Short gastric veins
Hepatic portal vein
Right gastric vein
Posterior superior pancreaticoduodenal vein
Superior mesenteric vein
Right gastro-omental (gastro-epiploic) vein
Anterior superior pancreaticoduodenal vein
Left gastro-omental (gastro-epiploic) vein
(Great) pancreatic vein
Anterior inferior pancreaticoduodenal vein
Inferior mesenteric vein
Posterior inferior pancreaticoduodenal vein

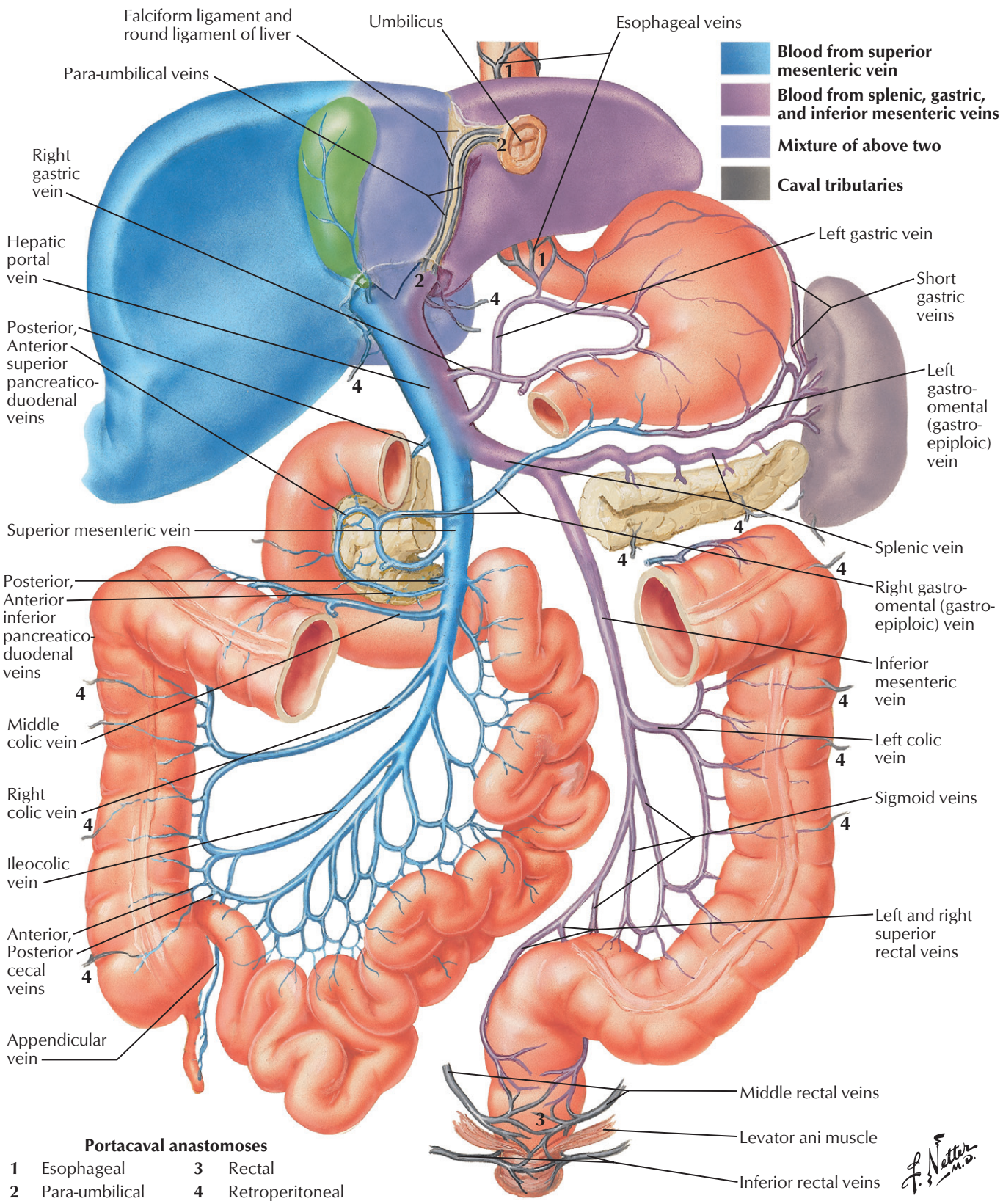


Relations of superior mesenteric vein and artery in root of mesentery

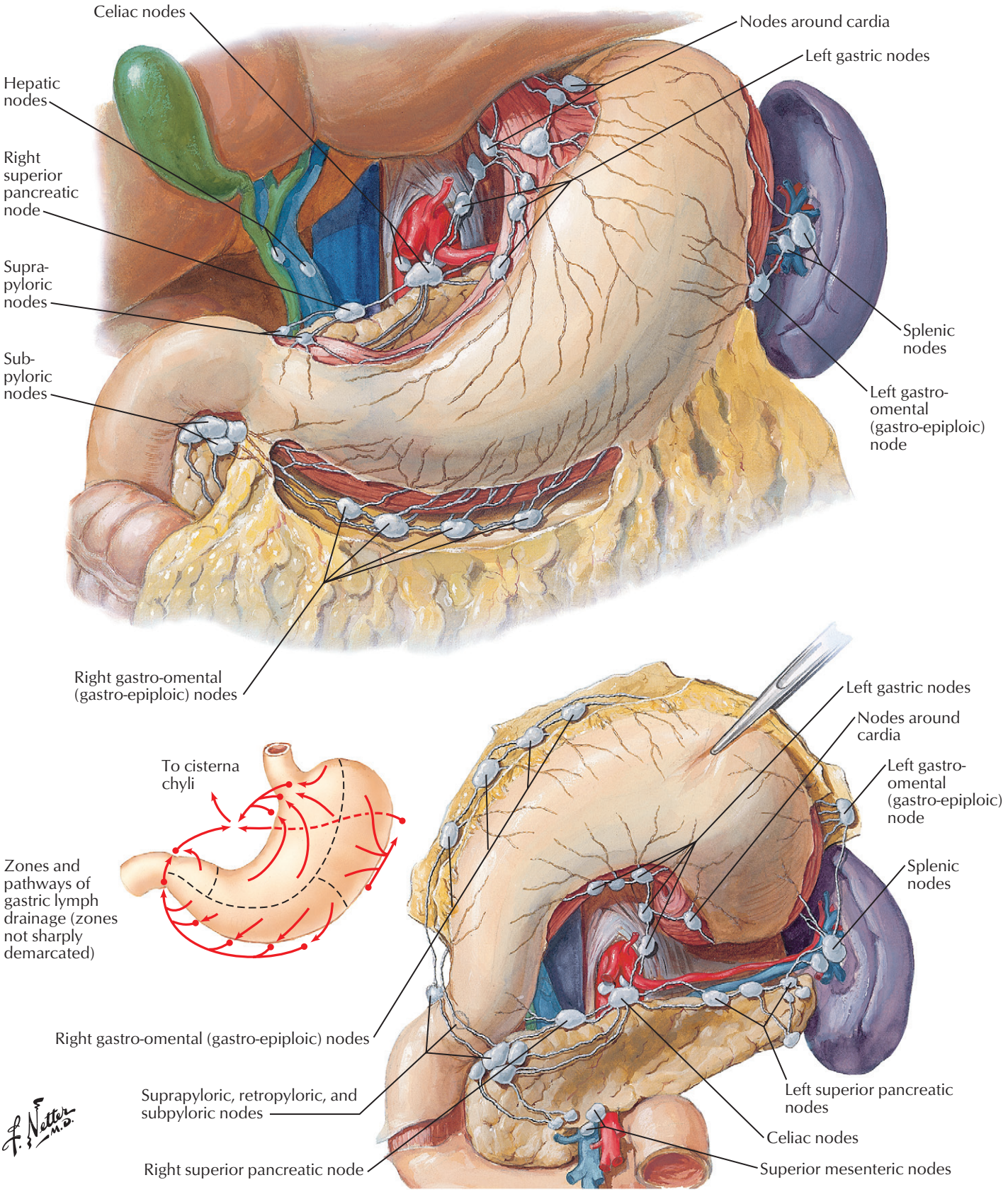
Veins of Large Intestine

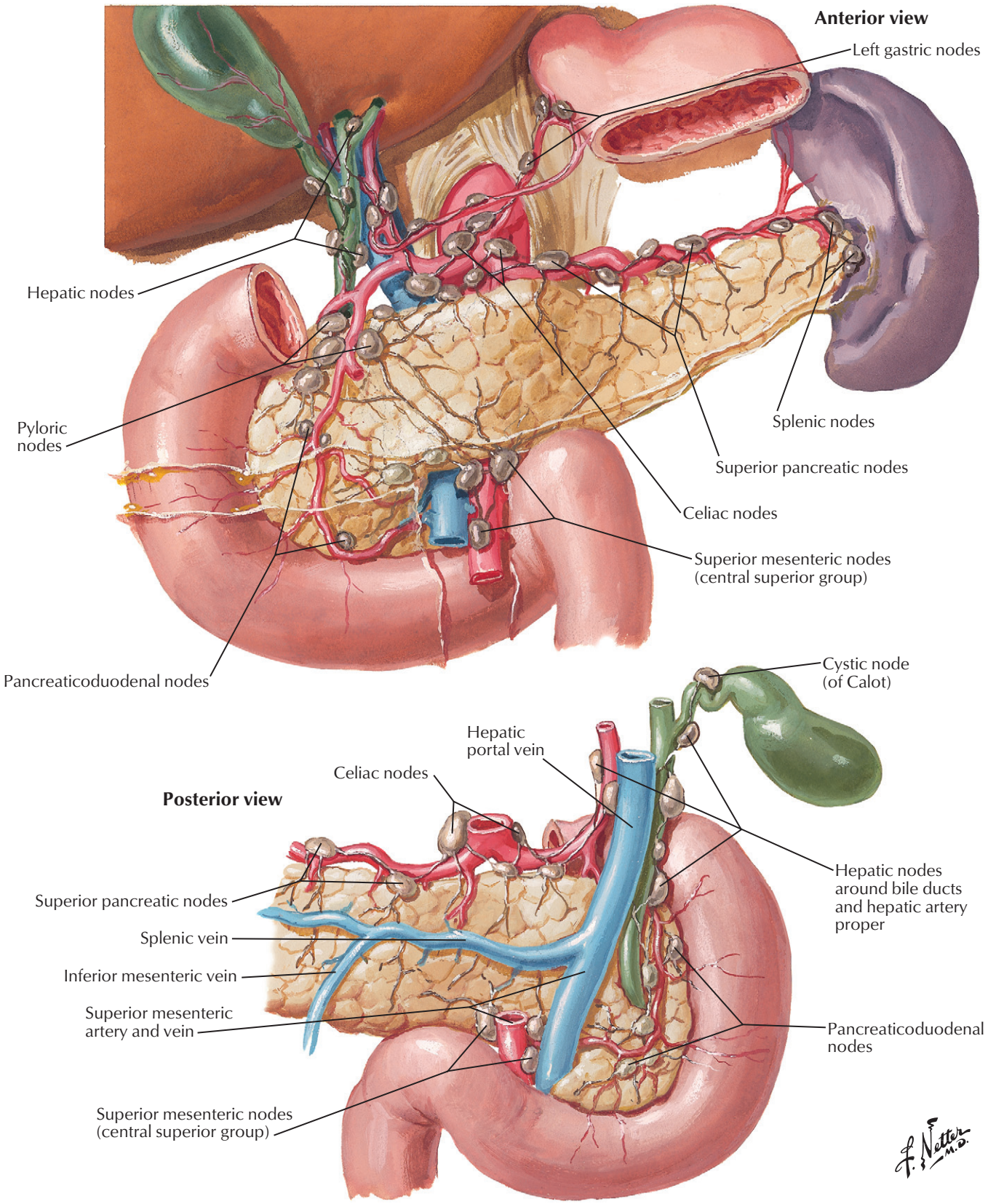
For veins of rectum see also Plate 377



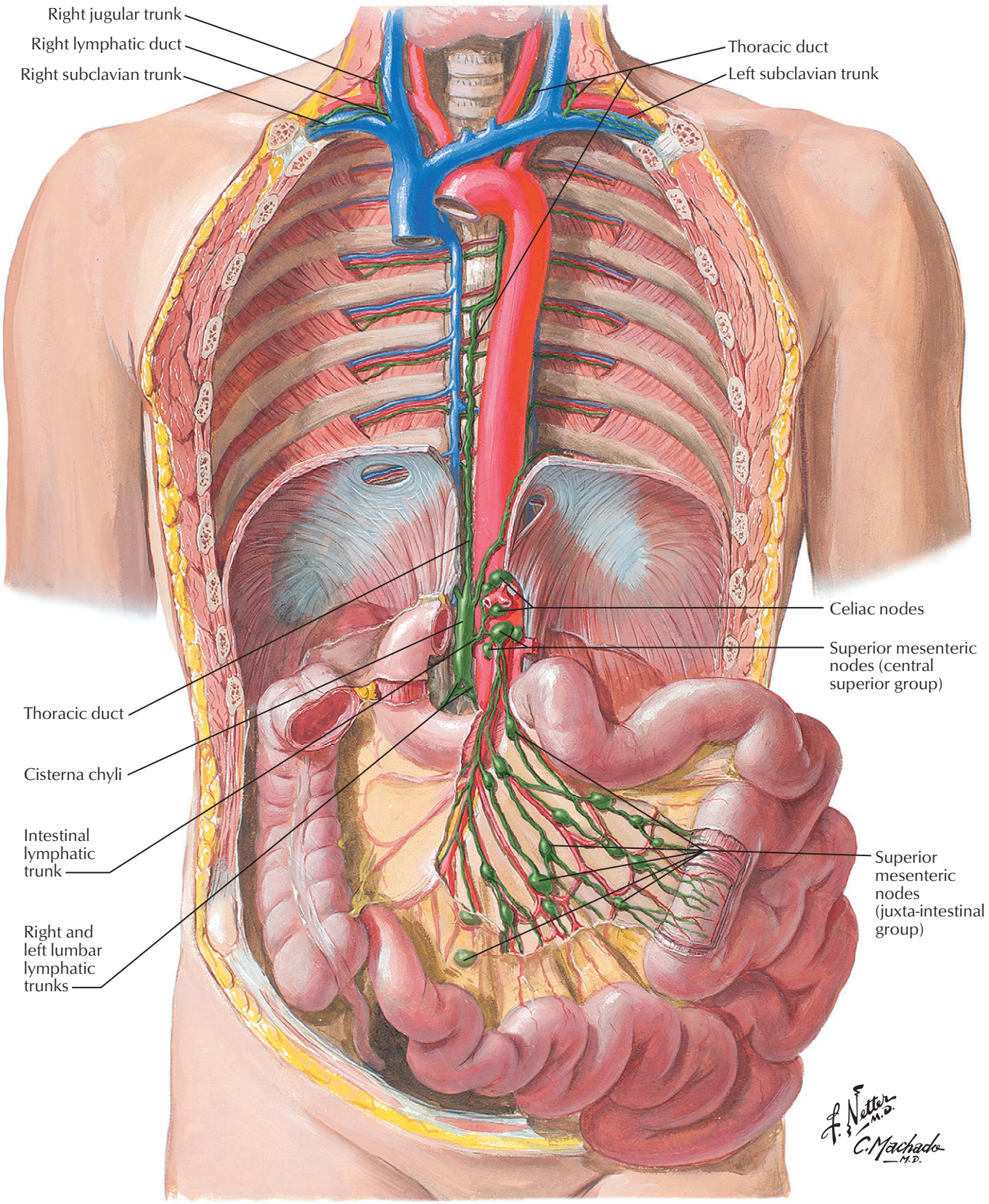

Falciform ligament and round ligament of liver
Umbilicus
Esophageal veins
Para-umbilical veins
Blood from superior mesenteric vein
Blood from splenic, gastric, and inferior mesenteric veins
Mixture of above two
Caval tributaries
Right gastric vein
Hepatic portal vein
Left gastric vein
Short gastric veins
Posterior, Anterior superior pancreatico-duodenal veins
Left gastro-omental (gastro-epiploic) vein
Superior mesenteric vein
Splenic vein
Posterior, Anterior inferior pancreatico-duodenal veins
Right gastro-omental (gastro-epiploic) vein
Inferior mesenteric vein
Middle colic vein
Left colic vein
Right colic vein
Sigmoid veins
Ileocolic vein
Left and right superior rectal veins
Anterior, Posterior cecal veins
Appendicular vein
Middle rectal veins
Levator ani muscle
Inferior rectal veins
Portacaval anastomoses
1 Esophageal
2 Para-umbilical
3 Rectal
4 Retroperitoneal

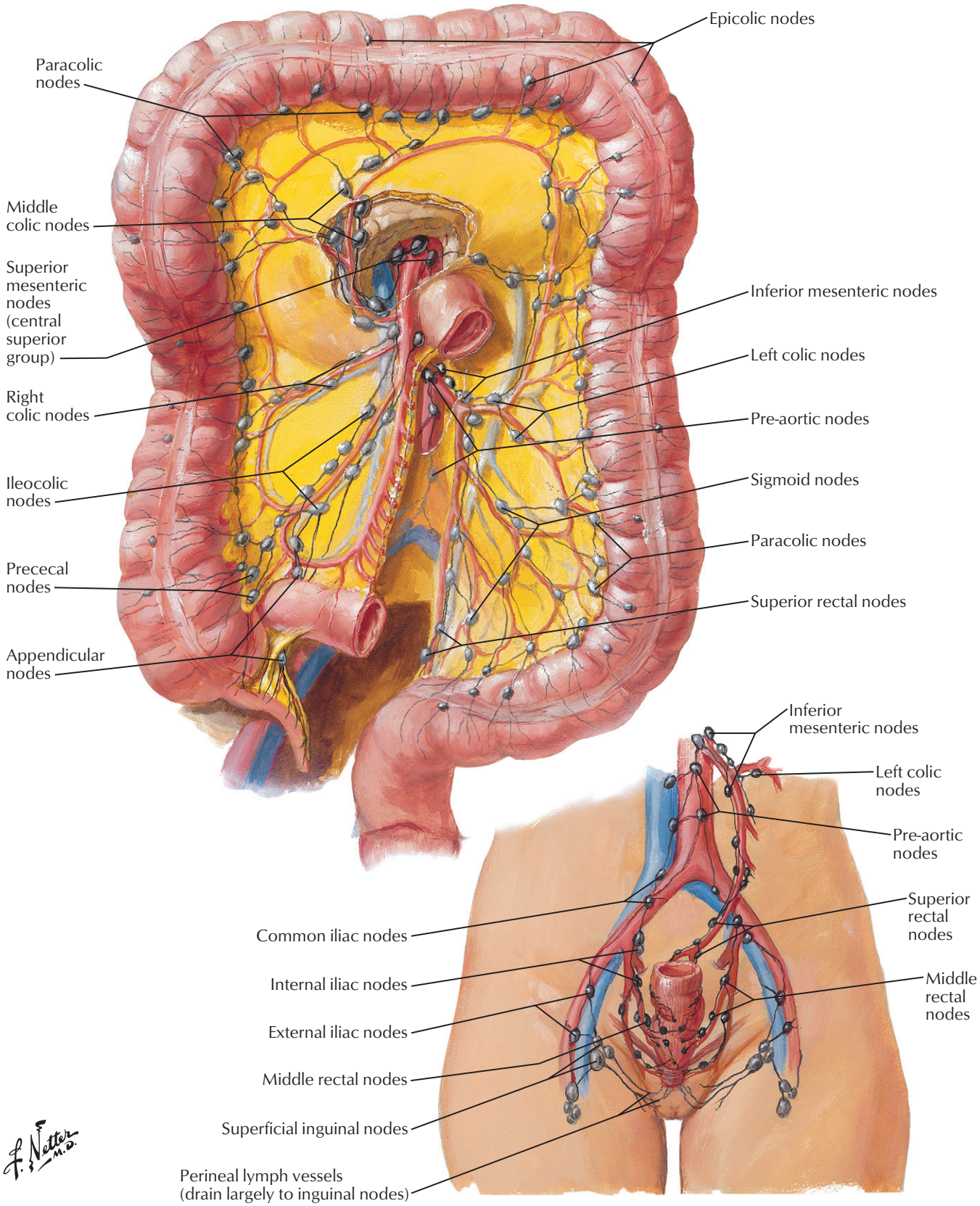
Lymph Vessels and Nodes of Stomach



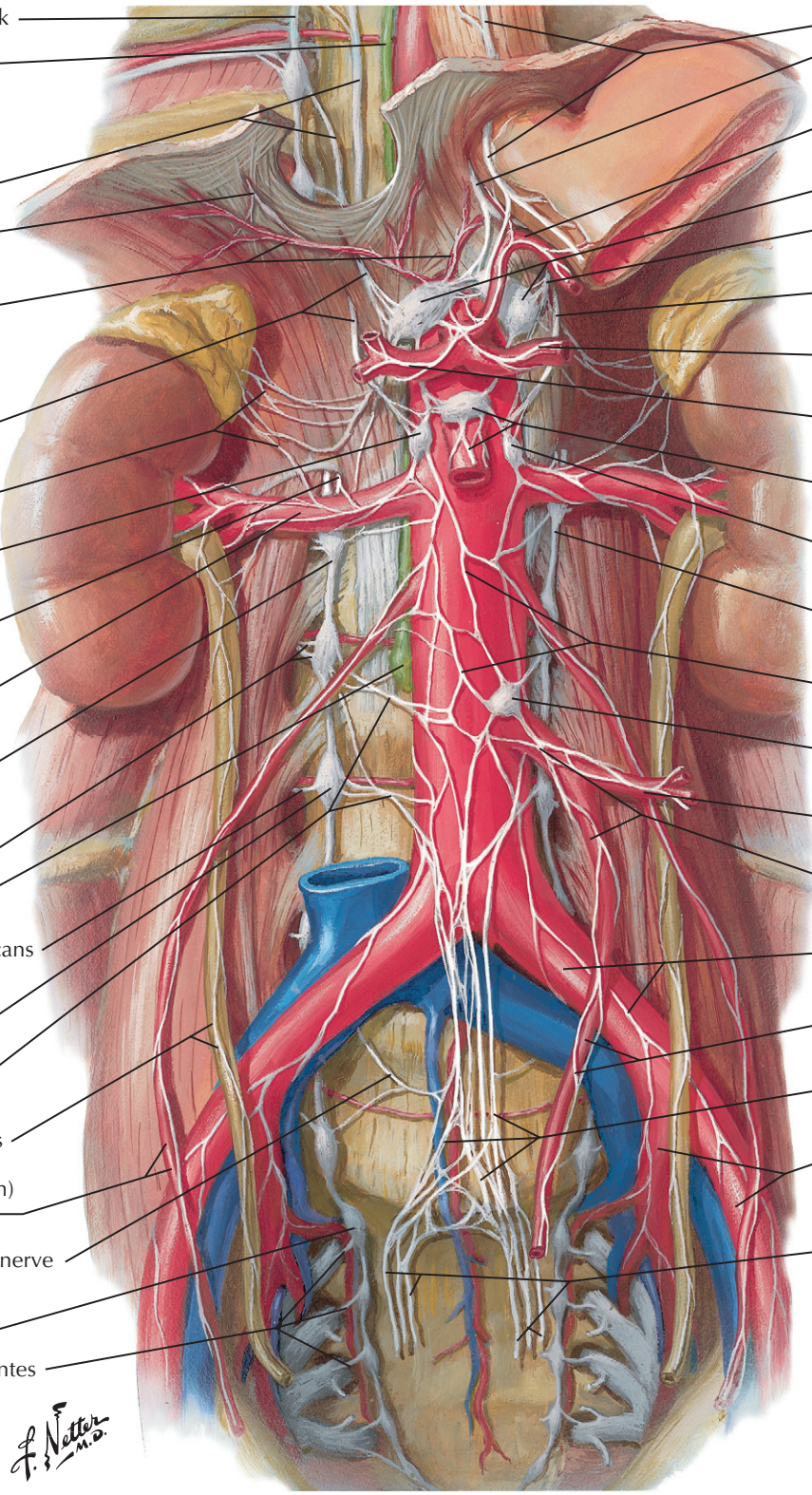

Anterior view
Left gastric nodes
Hepatic nodes
Pyloric nodes
Splenic nodes
Superior pancreatic nodes
Celiac nodes
Superior mesenteric nodes (central superior group)
Pancreaticoduodenal nodes
Cystic node (of Calot)
Hepatic portal vein
Celiac nodes
Posterior view
Hepatic nodes around bile ducts and hepatic artery proper
Superior pancreatic nodes
Splenic vein
Inferior mesenteric vein
Superior mesenteric artery and vein
Pancreaticoduodenal nodes
Superior mesenteric nodes (central superior group)

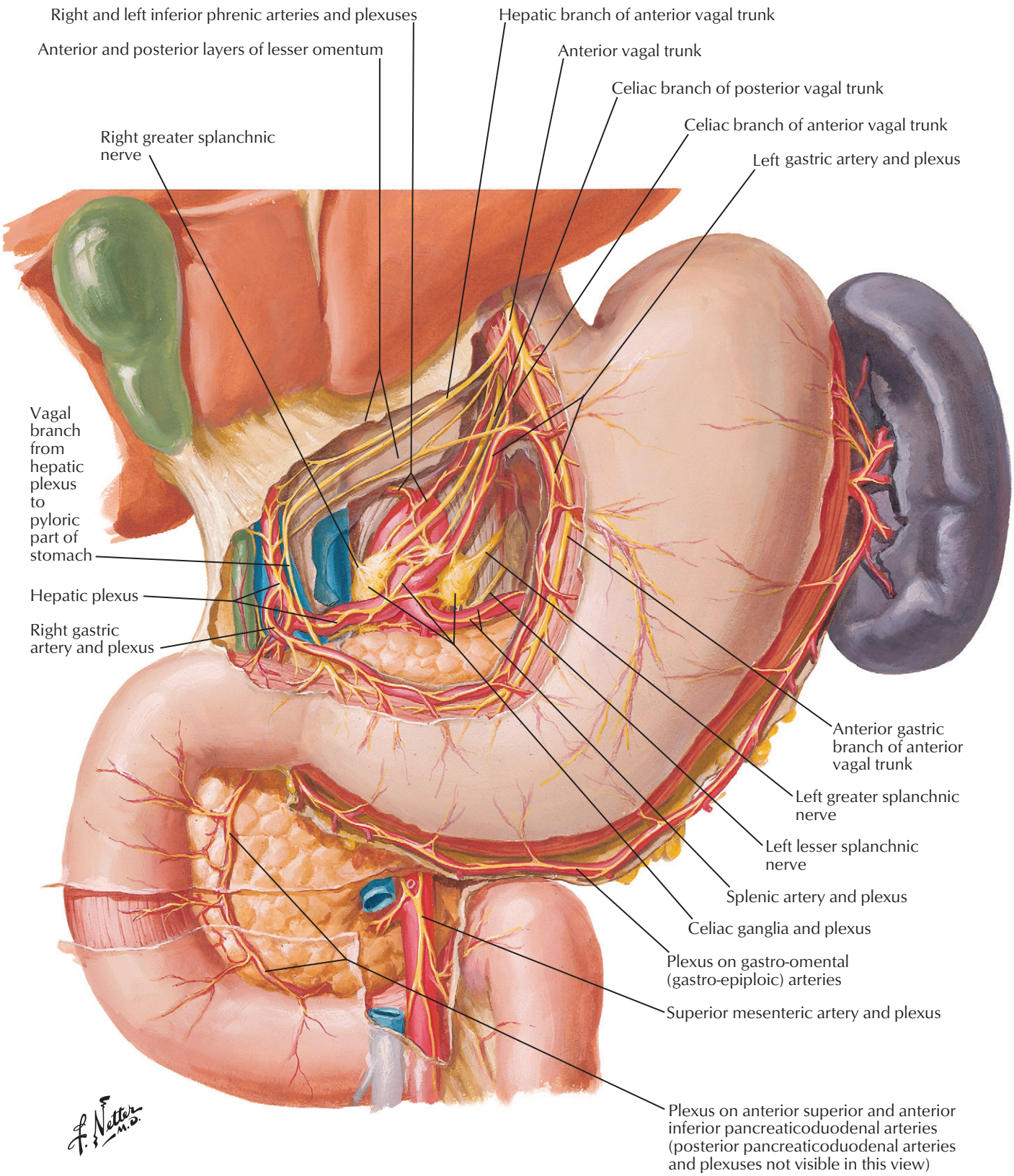
Lymph Vessels and Nodes of Small Intestine

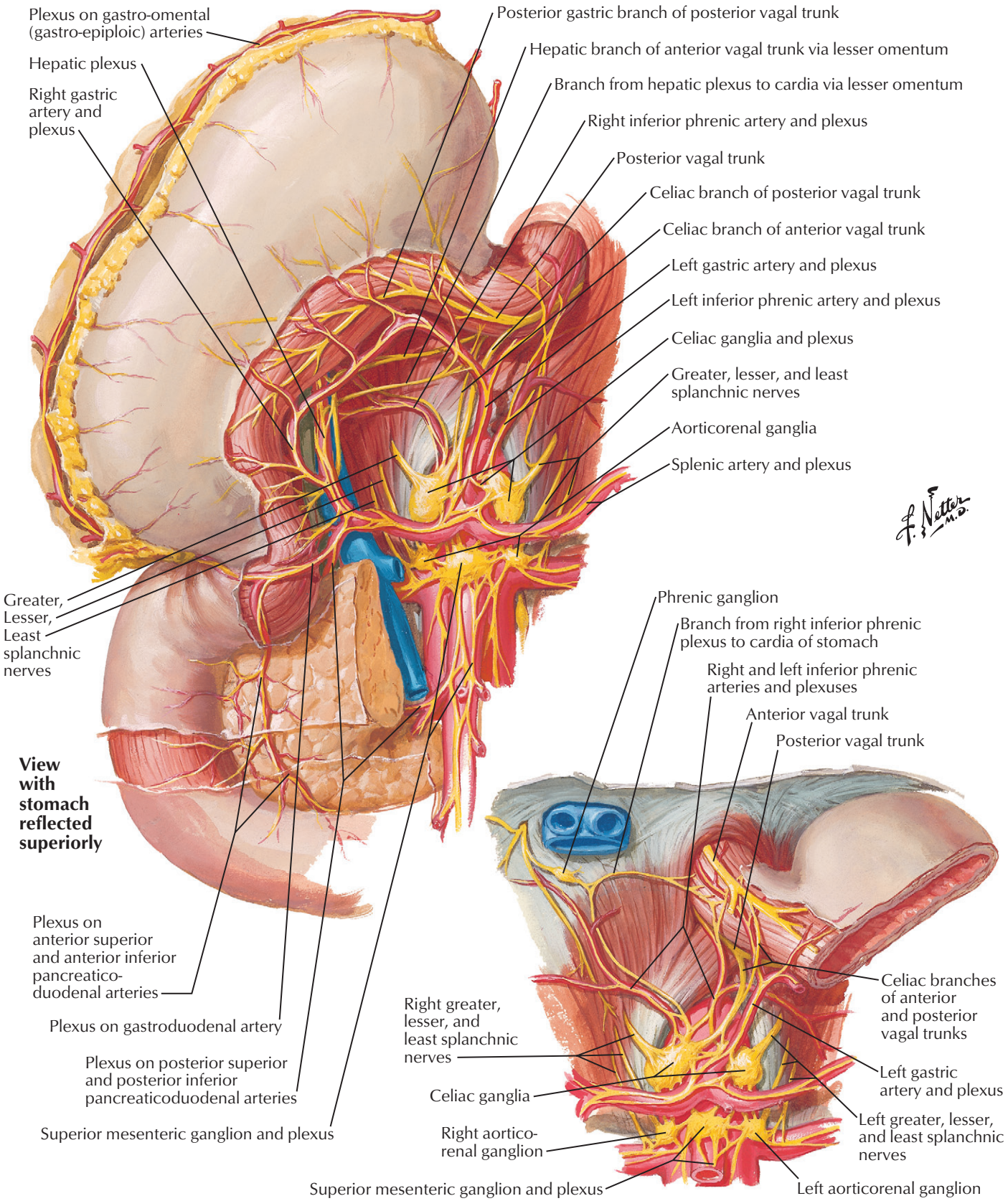



Epicolic nodes
Paracolic nodes
Middle colic nodes
Superior mesenteric nodes (central superior group)
Right colic nodes
Ileocolic nodes
Prececal nodes
Appendicular nodes
Inferior mesenteric nodes
Left colic nodes
Pre-aortic nodes
Sigmoid nodes
Paracolic nodes
Superior rectal nodes
Inferior mesenteric nodes
Left colic nodes
Pre-aortic nodes
Superior rectal nodes
Middle rectal nodes
Common iliac nodes
Internal iliac nodes
External iliac nodes
Middle rectal nodes
Superficial inguinal nodes
Perineal lymph vessels (drain largely to inguinal nodes)

Autonomic Nerves and Ganglia of Abdomen

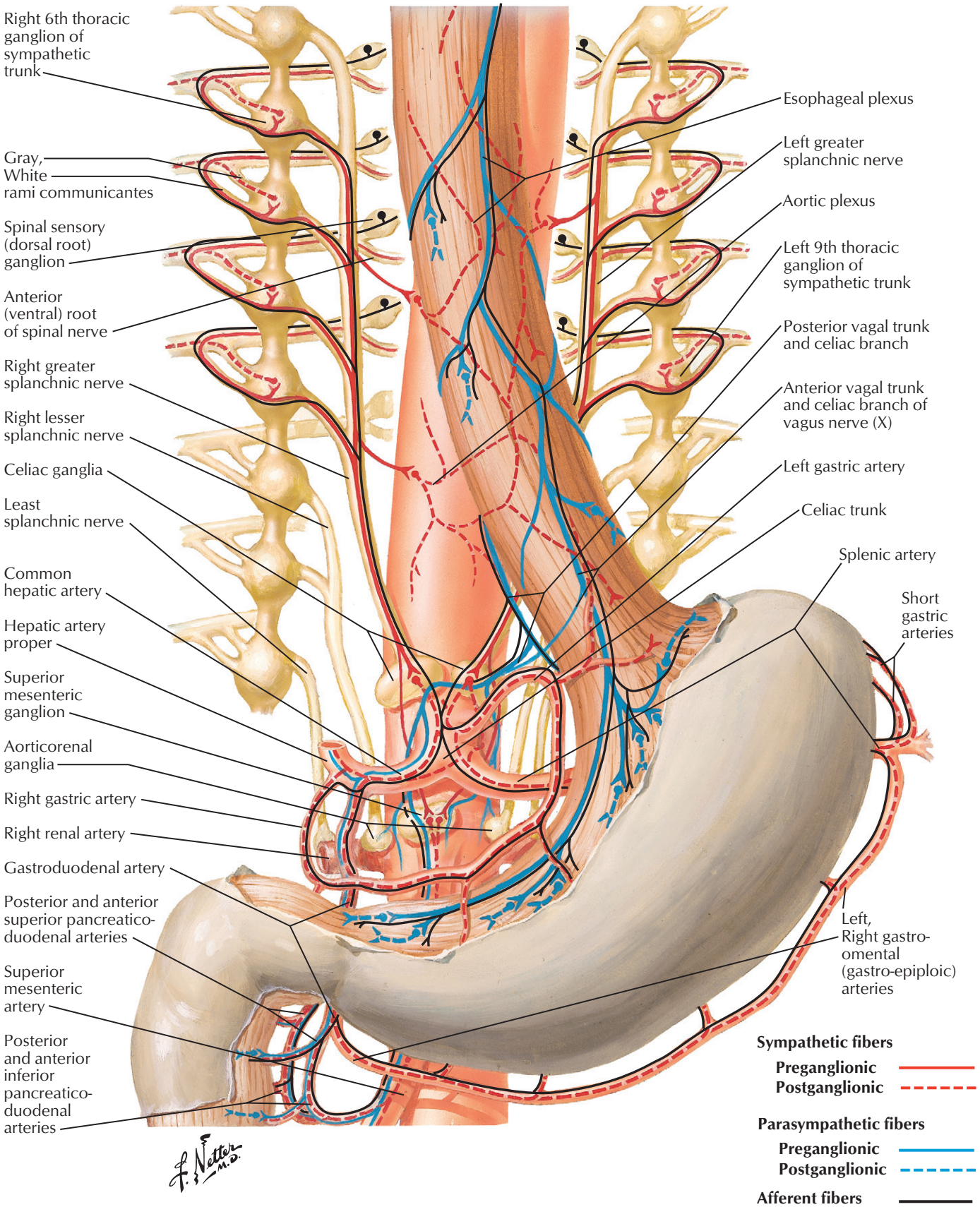


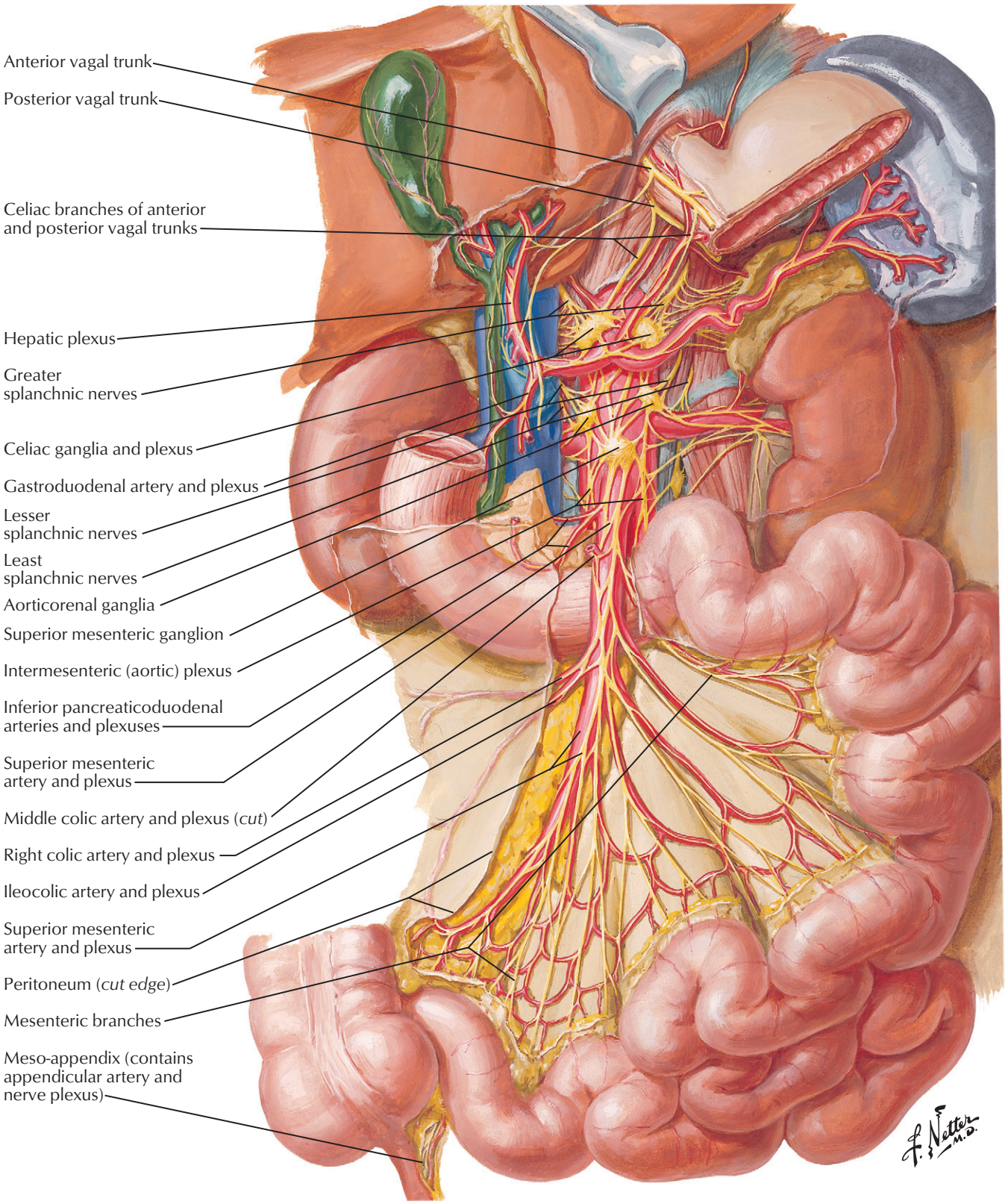

Right and left inferior phrenic arteries and plexuses
Anterior and posterior layers of lesser omentum
Hepatic branch of anterior vagal trunk
Anterior vagal trunk
Celiac branch of posterior vagal trunk
Celiac branch of anterior vagal trunk
Left gastric artery and plexus
Right greater splanchnic nerve
Vagal branch from hepatic plexus to pyloric part of stomach
Hepatic plexus
Right gastric artery and plexus
Anterior gastric branch of anterior vagal trunk
Left greater splanchnic nerve
Left lesser splanchnic nerve
Splenic artery and plexus
Celiac ganglia and plexus
Plexus on gastro-omental (gastro-epiploic) arteries
Superior mesenteric artery and plexus
Plexus on anterior superior and anterior inferior pancreaticoduodenal arteries (posterior pancreaticoduodenal arteries and plexuses not visible in this view)
F. Netter M.D.


Plexus on gastro-omental (gastro-epiploic) arteries
Hepatic plexus
Right gastric artery and plexus
Posterior gastric branch of posterior vagal trunk
Hepatic branch of anterior vagal trunk via lesser omentum
Branch from hepatic plexus to cardia via lesser omentum
Right inferior phrenic artery and plexus
Posterior vagal trunk
Celiac branch of posterior vagal trunk
Celiac branch of anterior vagal trunk
Left gastric artery and plexus
Left inferior phrenic artery and plexus
Celiac ganglia and plexus
Greater, lesser, and least splanchnic nerves
Aorticorenal ganglia
Splenic artery and plexus
Greater, Lesser, Least splanchnic nerves
View with stomach reflected superiorly
Plexus on anterior superior and anterior inferior pancreatico-duodenal arteries
Plexus on gastroduodenal artery
Plexus on posterior superior and posterior inferior pancreaticoduodenal arteries
Superior mesenteric ganglion and plexus
Phrenic ganglion
Branch from right inferior phrenic plexus to cardia of stomach
Right and left inferior phrenic arteries and plexuses
Anterior vagal trunk
Posterior vagal trunk
Celiac branches of anterior and posterior vagal trunks
Right greater, lesser, and least splanchnic nerves
Left gastric artery and plexus
Celiac ganglia
Left greater, lesser, and least splanchnic nerves
Right aortico-renal ganglion
Superior mesenteric ganglion and plexus
Left aorticorenal ganglion

Autonomic Innervation of Stomach and Duodenum: Schema

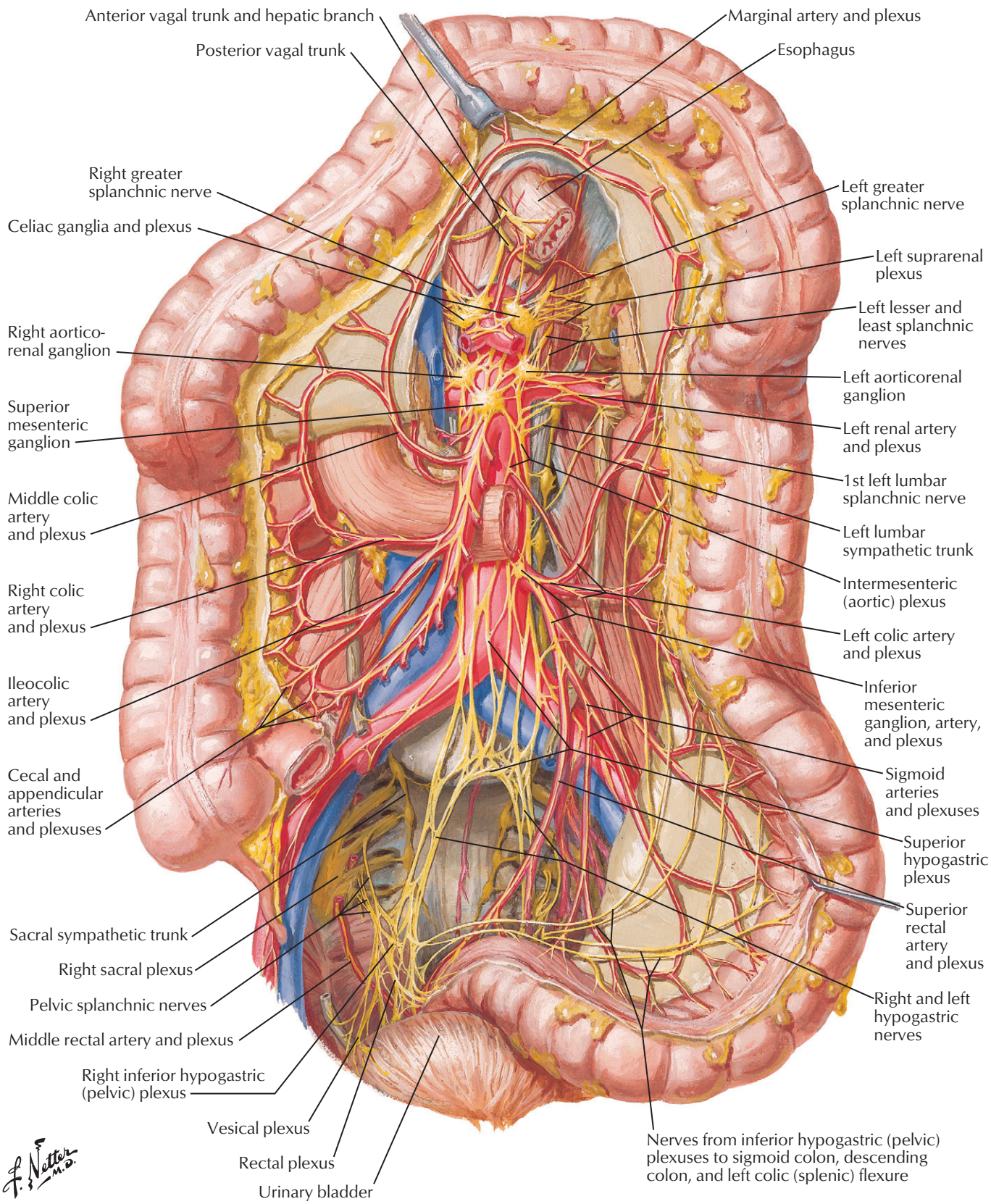
See also Plates 163, 164




Anterior vagal trunk
Posterior vagal trunk
Celiac branches of anterior and posterior vagal trunks
Hepatic plexus
Greater splanchnic nerves
Celiac ganglia and plexus
Gastroduodenal artery and plexus
Lesser splanchnic nerves
Least splanchnic nerves
Aorticorenal ganglia
Superior mesenteric ganglion
Intermesenteric (aortic) plexus
Inferior pancreaticoduodenal arteries and plexuses
Superior mesenteric artery and plexus
Middle colic artery and plexus (cut)
Right colic artery and plexus
Ileocolic artery and plexus
Superior mesenteric artery and plexus
Peritoneum (cut edge)
Mesenteric branches
Meso-appendix (contains appendicular artery and nerve plexus)

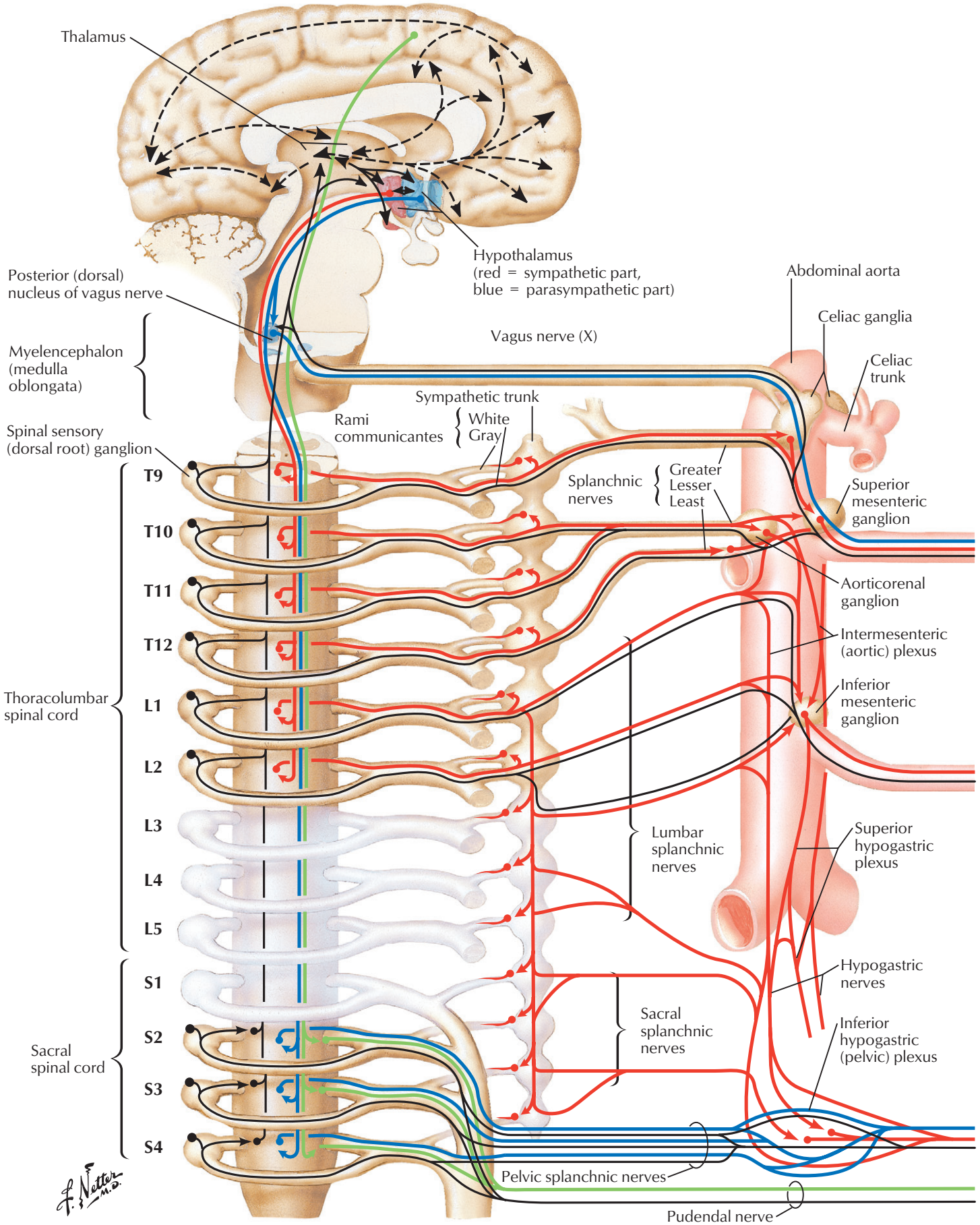
Autonomic Innervation of Large Intestine

For nerves of rectum see Plates 388–391



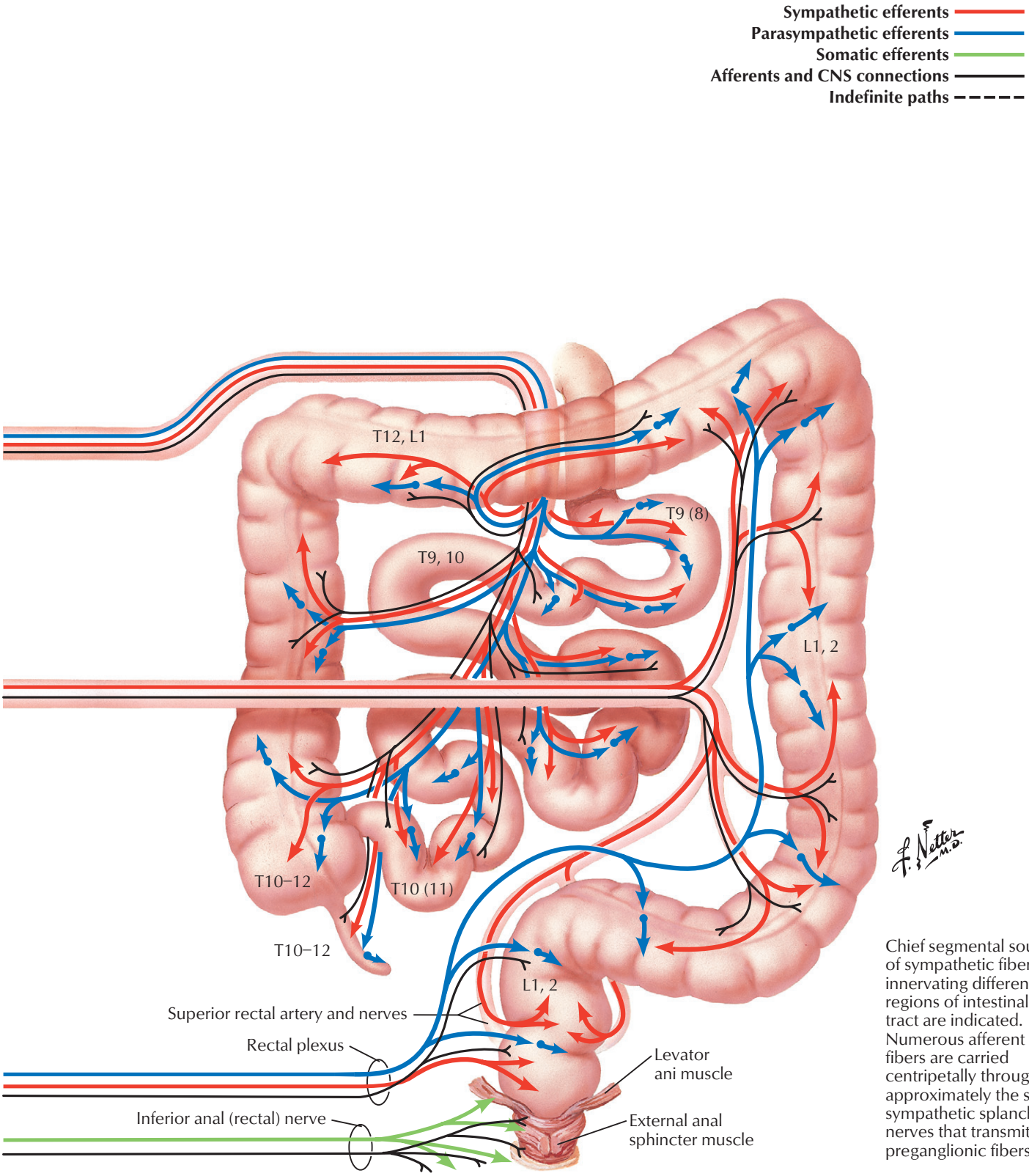
Autonomic Innervation of Small and Large Intestines: Schema

See also Plates 163, 164



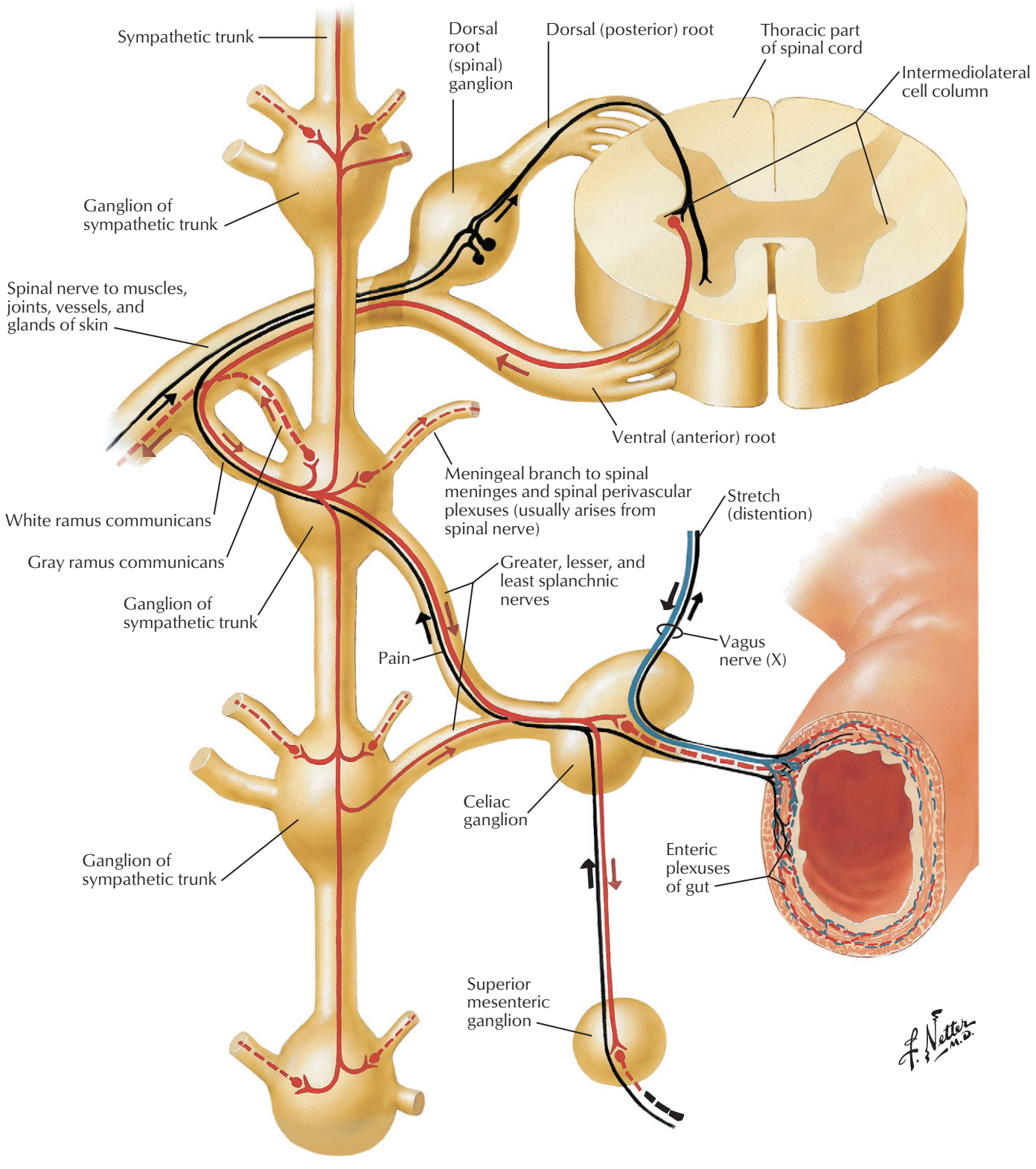
Autonomic Innervation of Small and Large Intestines: Schema

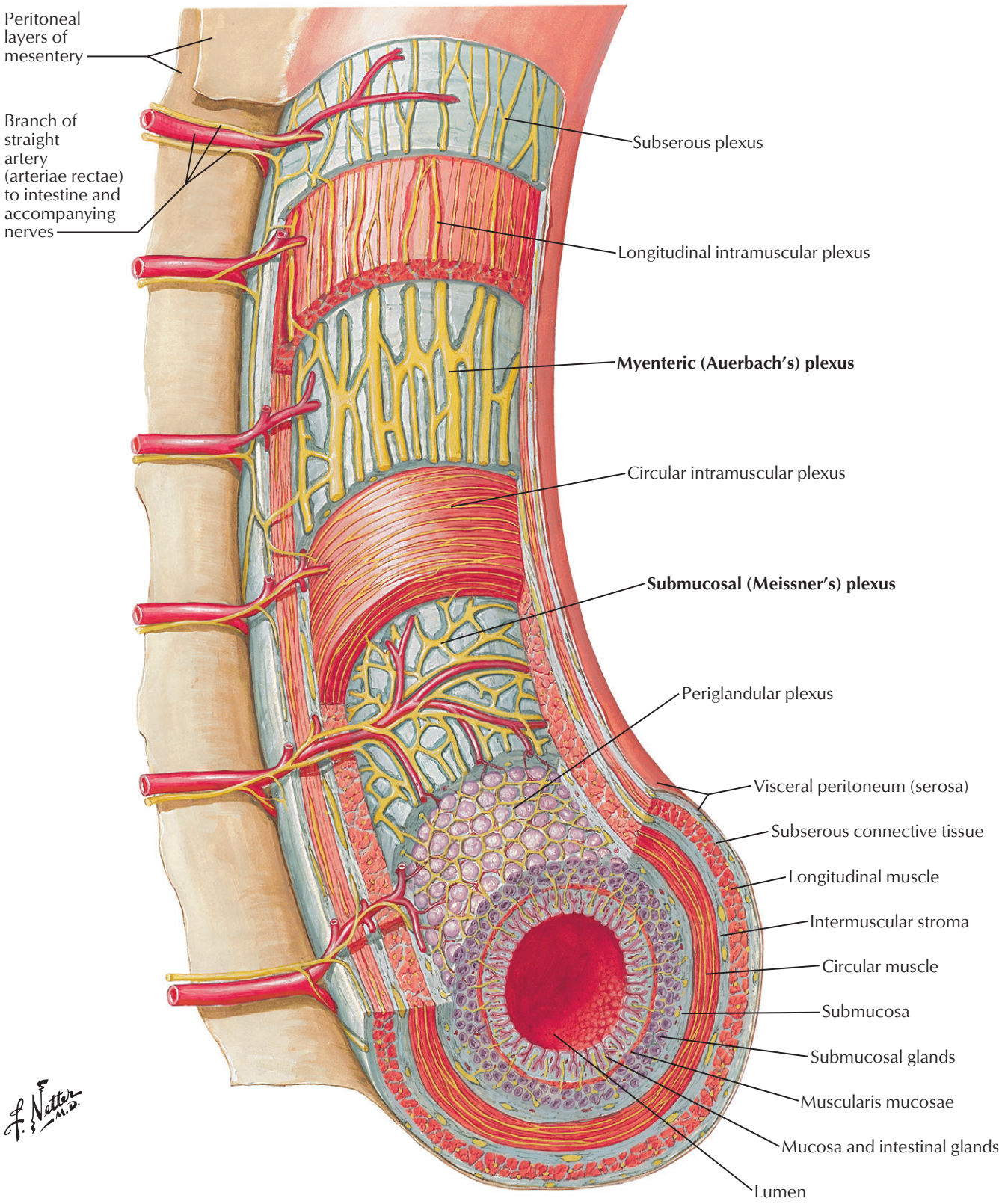
See also **Plates 163, 164**



Chief segmental sources of sympathetic fibers innervating different regions of intestinal tract are indicated. Numerous afferent fibers are carried centripetally through approximately the same sympathetic splanchnic nerves that transmit preganglionic fibers.

Autonomic Reflex Pathways: Schema

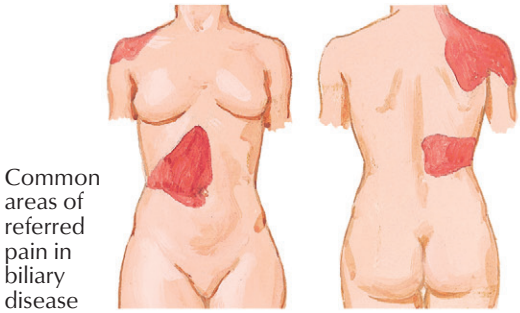




Note: Intestinal wall is shown much thicker than in actuality.

Autonomic Innervation of Liver and Biliary Tract: Schema

See also Plates 163, 164



Common areas of referred pain in biliary disease

Sympathetic trunk
Dorsal root (spinal) ganglion
Thoracic part of spinal cord
Left greater splanchnic nerve
Anterior vagal trunk
Right greater splanchnic nerve
Posterior vagal trunk
Right phrenic nerve to diaphragmatic part of parietal peritoneum
T7
T8
T9
T10

Hepatic branch of anterior vagal trunk
Diaphragm
Phrenic ganglion
Celiac ganglia
Common hepatic artery
Splenic artery
Anterior hepatic plexus
Posterior hepatic plexus
Aorta
Gastroduodenal artery and plexus
Sphincter of hepatopancreatic ampulla

Sympathetic fibers
- **Preganglionic**
- **Postganglionic**

Parasympathetic fibers
- **Preganglionic**
- **Postganglionic**

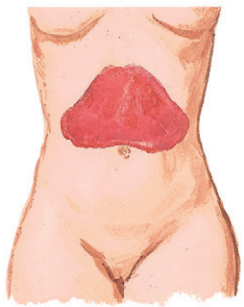
Afferent fibers



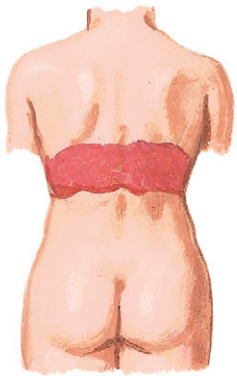
Ramification of nerve fibers around fine branch of hepatic artery

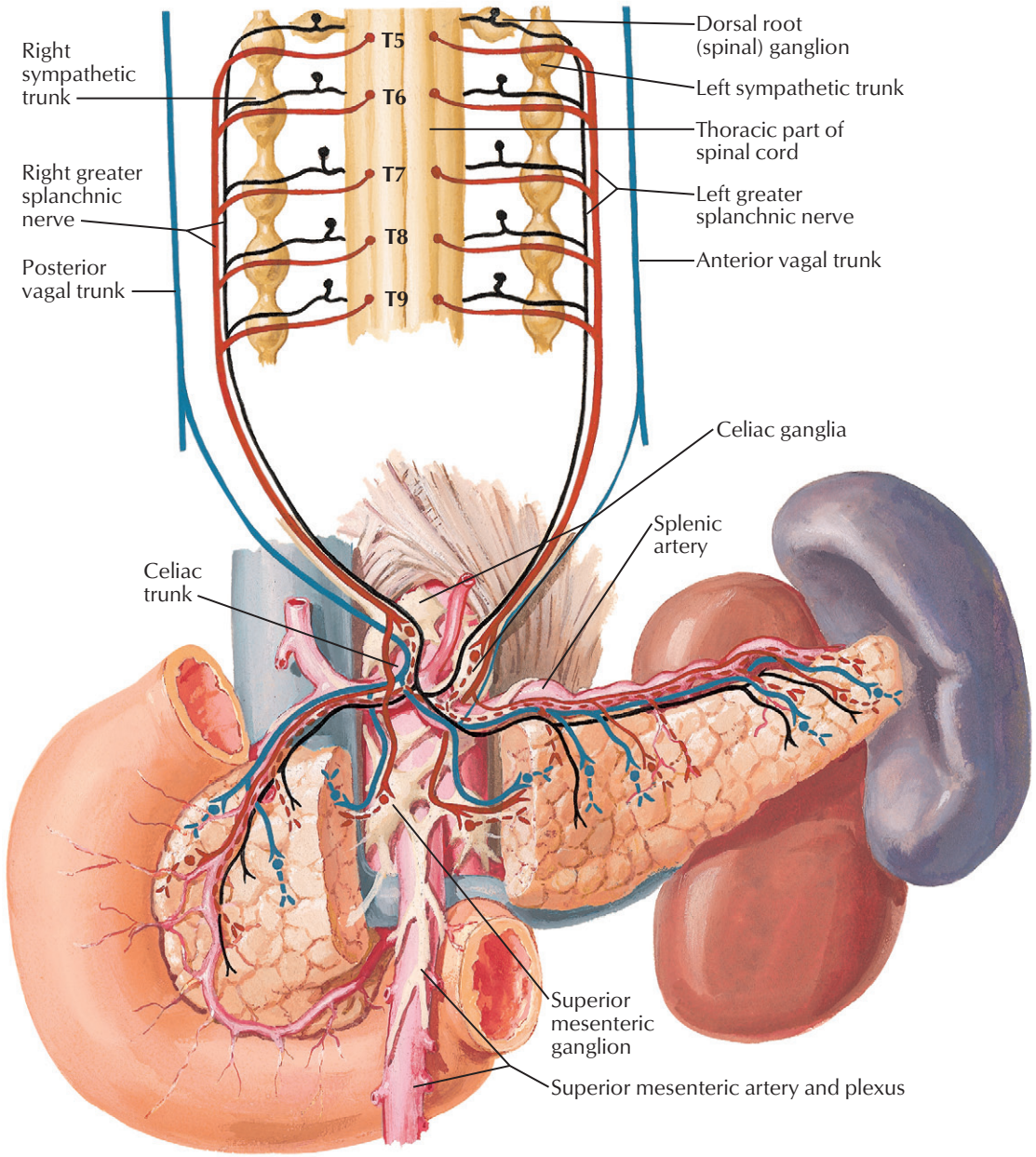
Autonomic Innervation of Pancreas: Schema

See also Plates 163, 164



Common areas of pancreatic pain





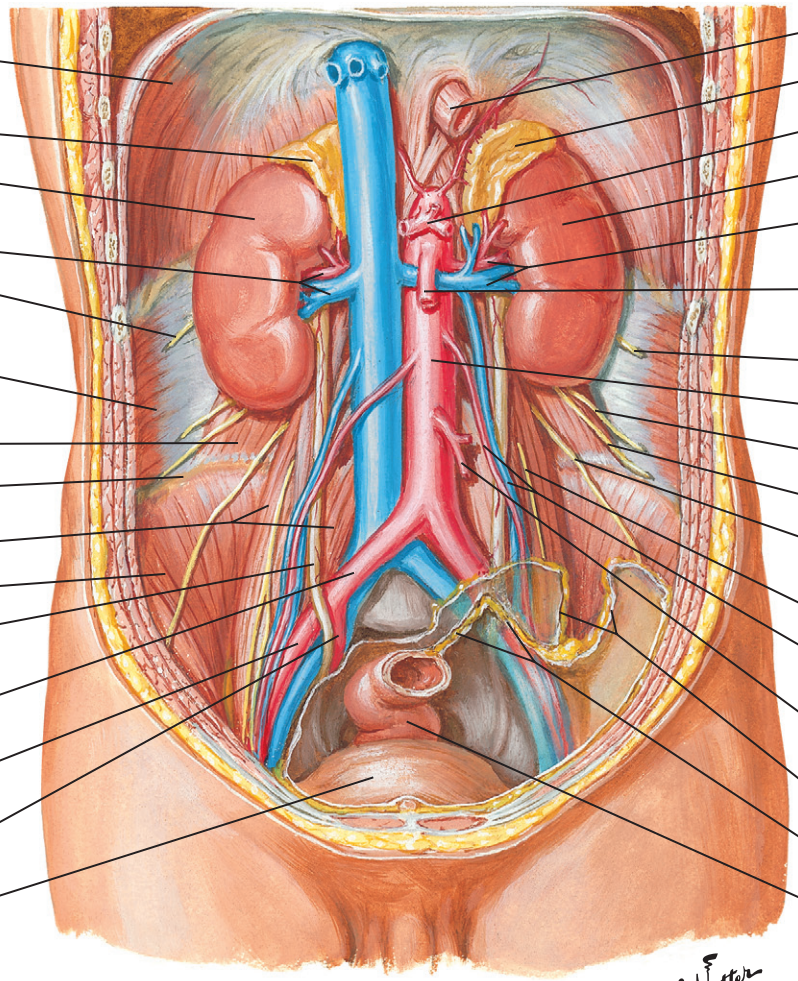
F. Netter M.D.

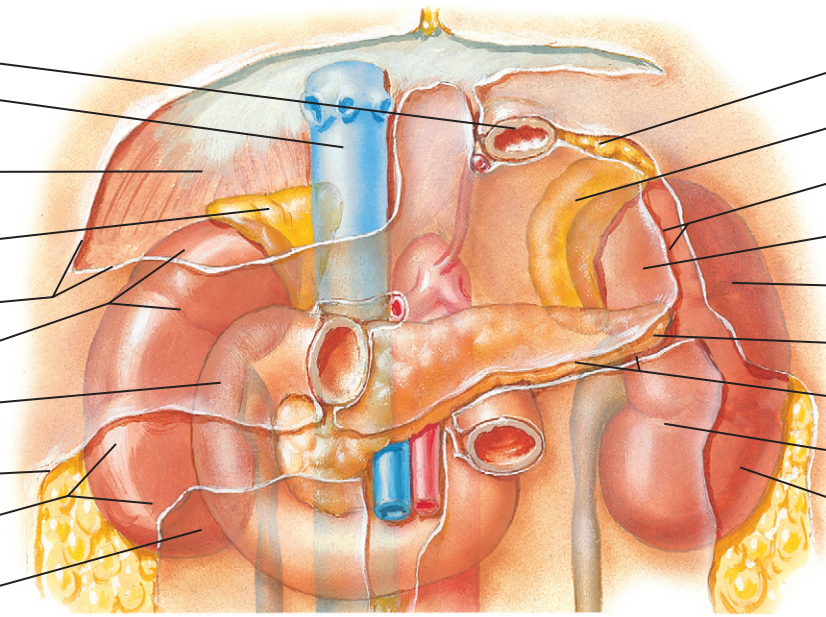
Sympathetic fibers
- Preganglionic
- Postganglionic

Parasympathetic fibers
- Preganglionic
- Postganglionic

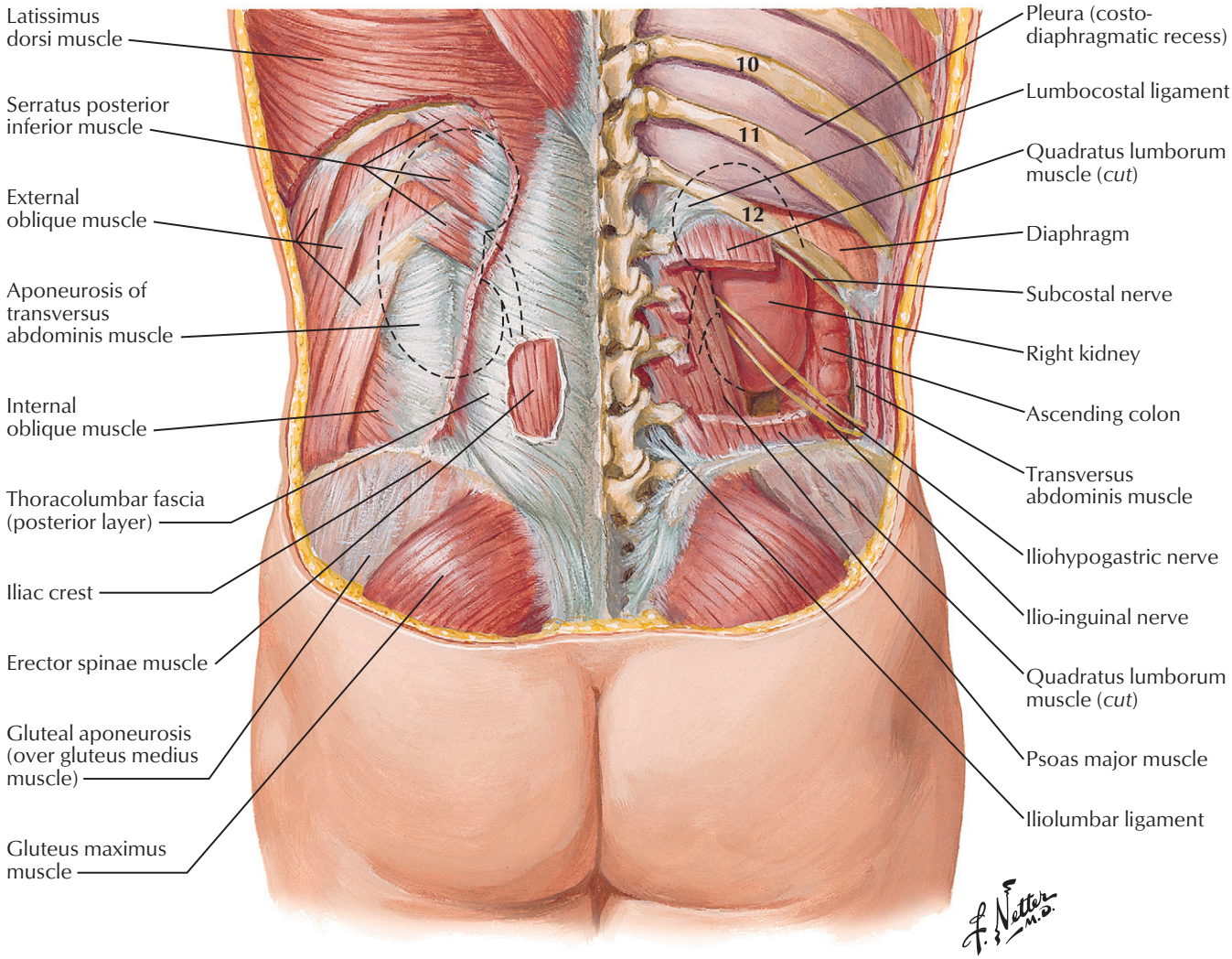
Afferent fibers

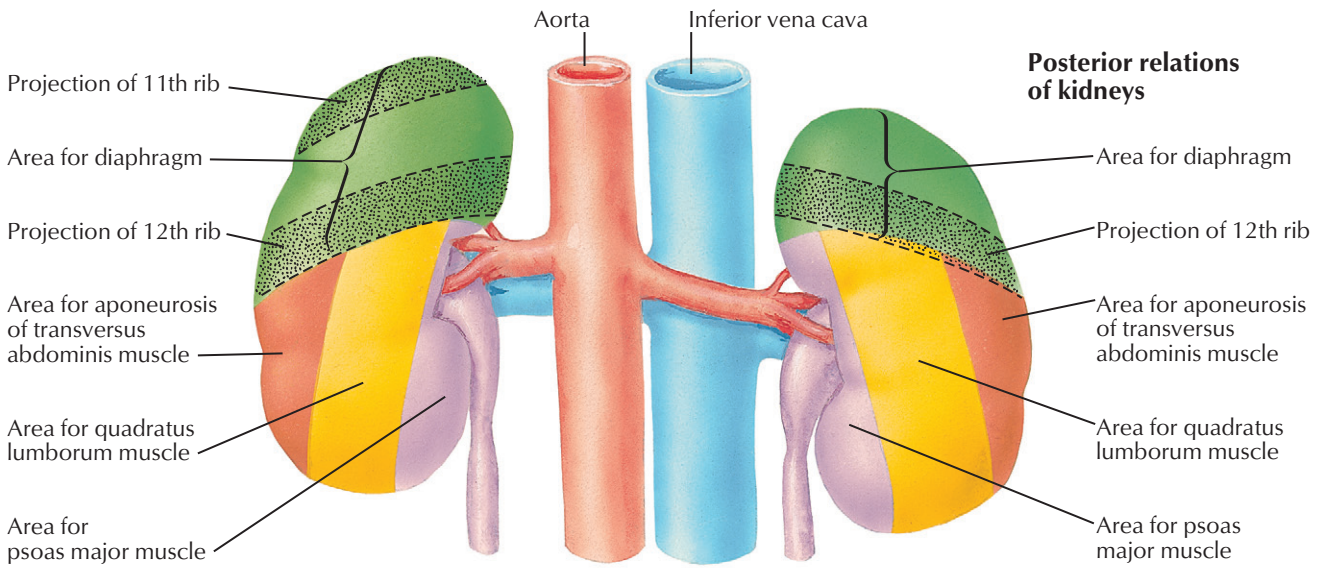
Kidneys in Situ: Anterior Views

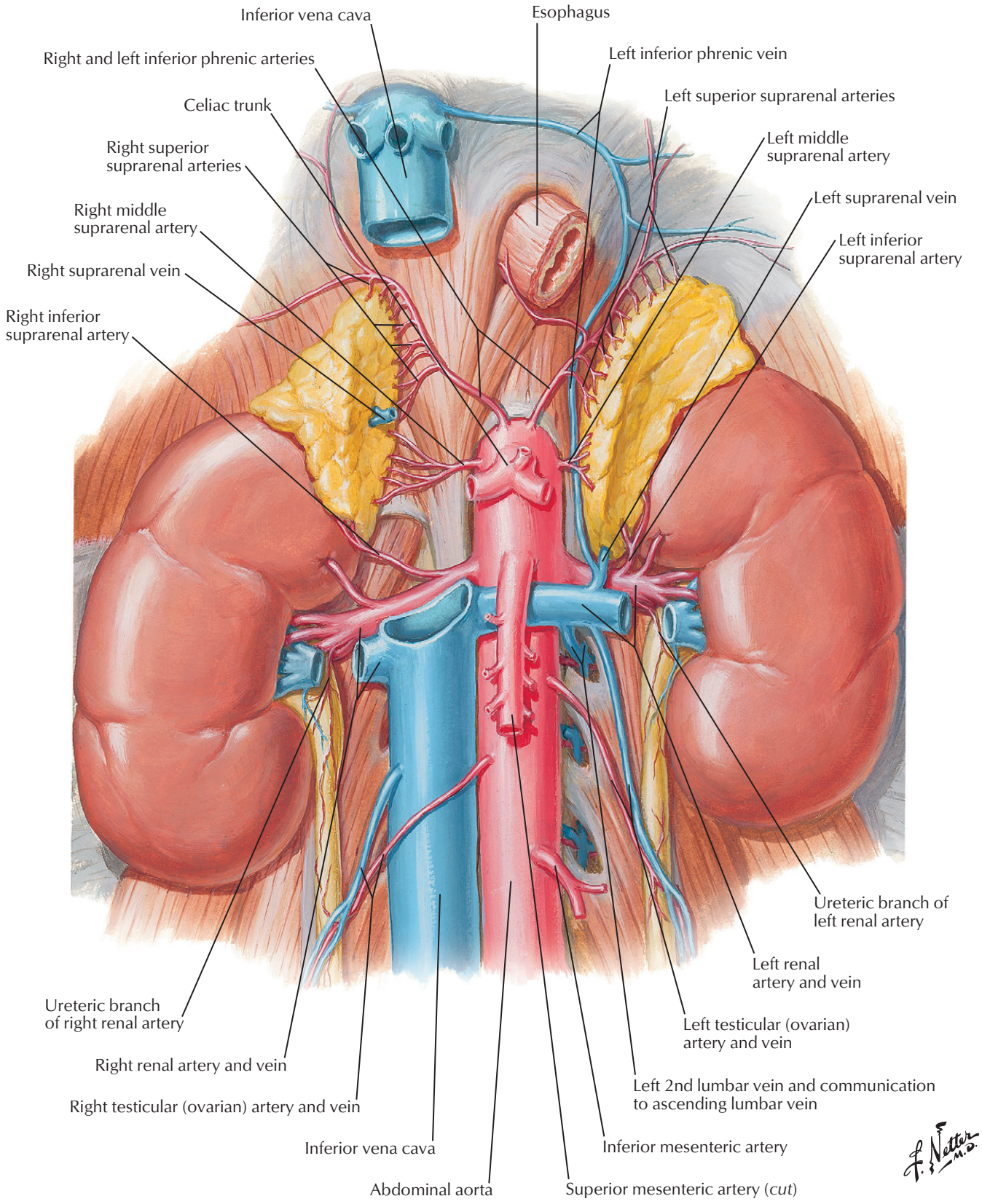


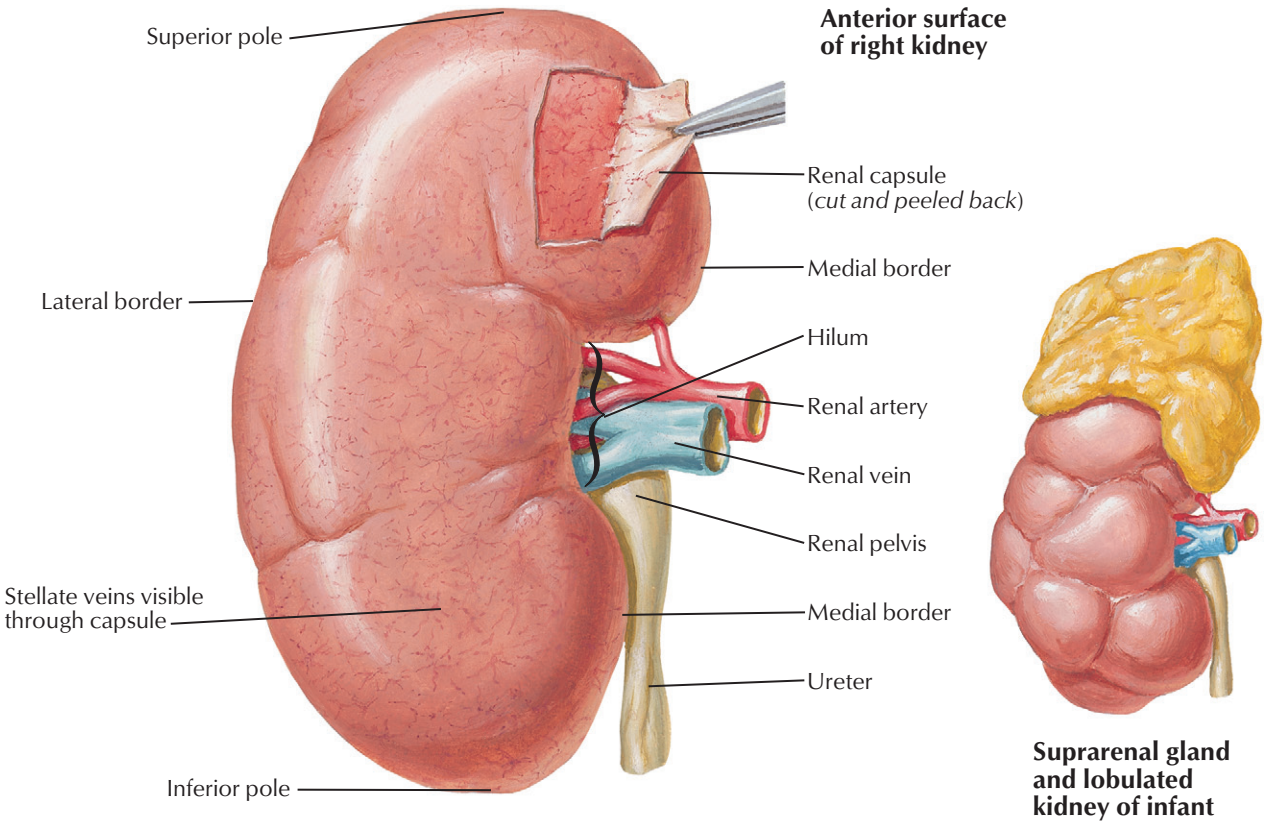


Anterior relations of kidneys

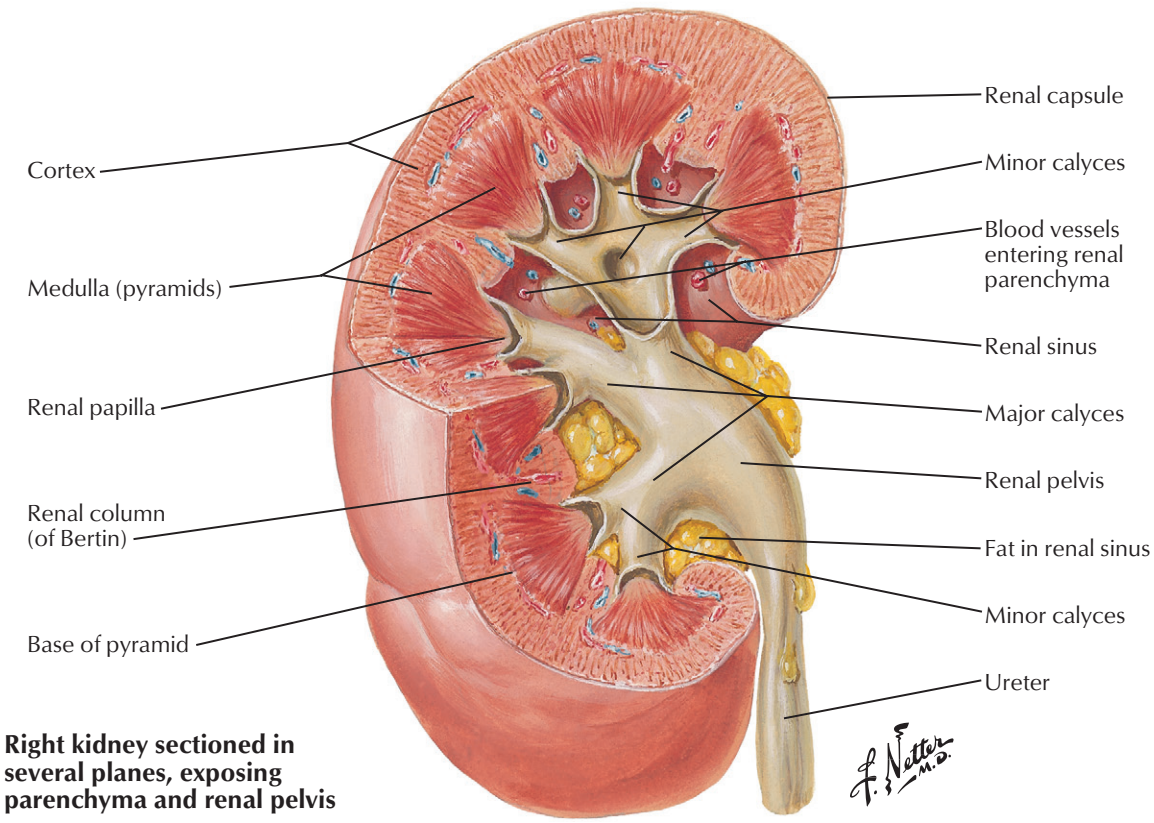

Latissimus dorsi muscle
Serratus posterior inferior muscle
External oblique muscle
Aponeurosis of transversus abdominis muscle
Internal oblique muscle
Thoracolumbar fascia (posterior layer)
Iliac crest
Erector spinae muscle
Gluteal aponeurosis (over gluteus medius muscle)
Gluteus maximus muscle
10
11
12
Pleura (costo-diaphragmatic recess)
Lumbocostal ligament
Quadratus lumborum muscle (cut)
Diaphragm
Subcostal nerve
Right kidney
Ascending colon
Transversus abdominis muscle
Iliohypogastric nerve
Ilio-inguinal nerve
Quadratus lumborum muscle (cut)
Psoas major muscle
Iliolumbar ligament
F. Netter M.D.


Aorta
Inferior vena cava
Posterior relations of kidneys
Projection of 11th rib
Area for diaphragm
Projection of 12th rib
Area for aponeurosis of transversus abdominis muscle
Area for quadratus lumborum muscle
Area for psoas major muscle
Area for diaphragm
Projection of 12th rib
Area for aponeurosis of transversus abdominis muscle
Area for quadratus lumborum muscle
Area for psoas major muscle

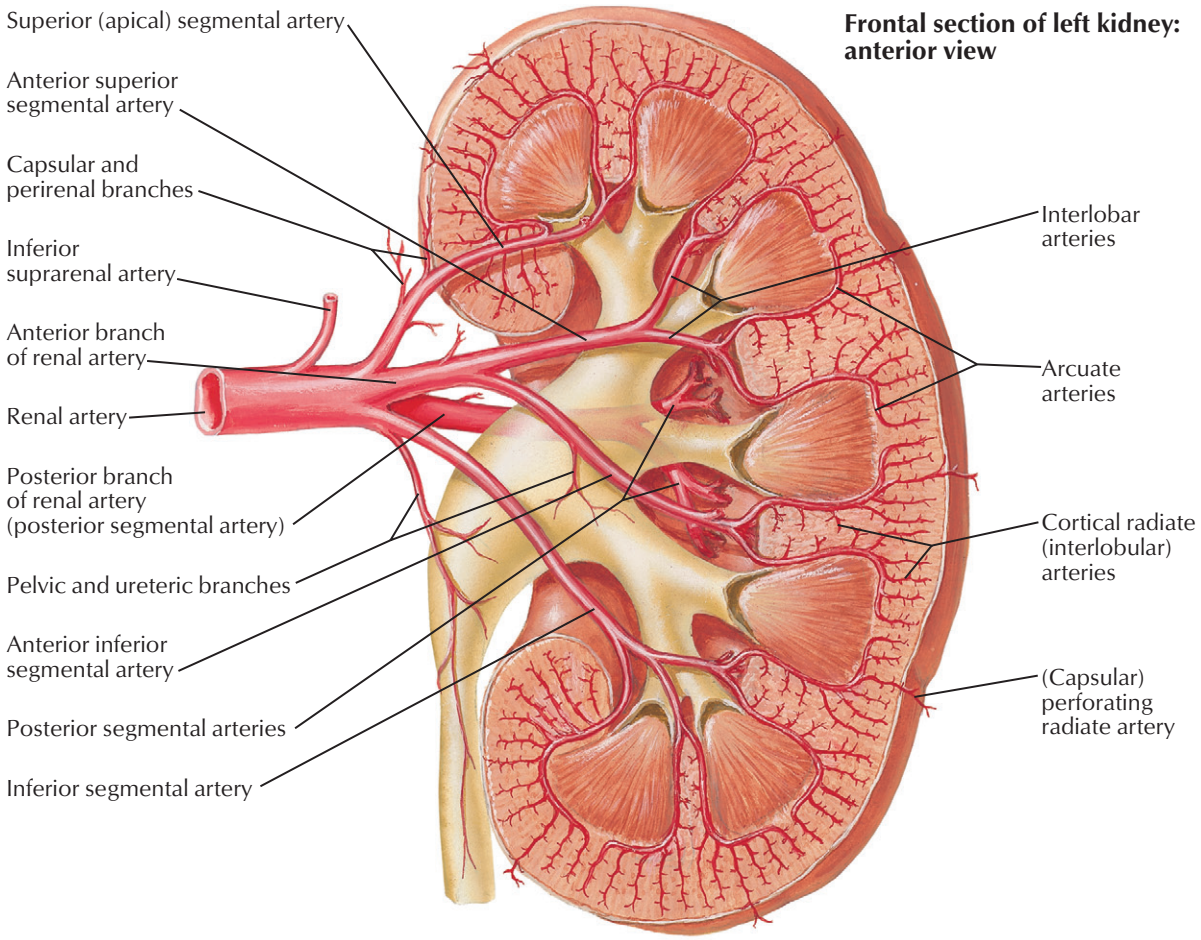

Inferior vena cava
Esophagus
Right and left inferior phrenic arteries
Left inferior phrenic vein
Celiac trunk
Left superior suprarenal arteries
Right superior suprarenal arteries
Left middle suprarenal artery
Right middle suprarenal artery
Left suprarenal vein
Right suprarenal vein
Left inferior suprarenal artery
Right inferior suprarenal artery
Ureteric branch of left renal artery
Left renal artery and vein
Ureteric branch of right renal artery
Left testicular (ovarian) artery and vein
Right renal artery and vein
Left 2nd lumbar vein and communication to ascending lumbar vein
Right testicular (ovarian) artery and vein
Inferior vena cava
Inferior mesenteric artery
Abdominal aorta
Superior mesenteric artery (cut)

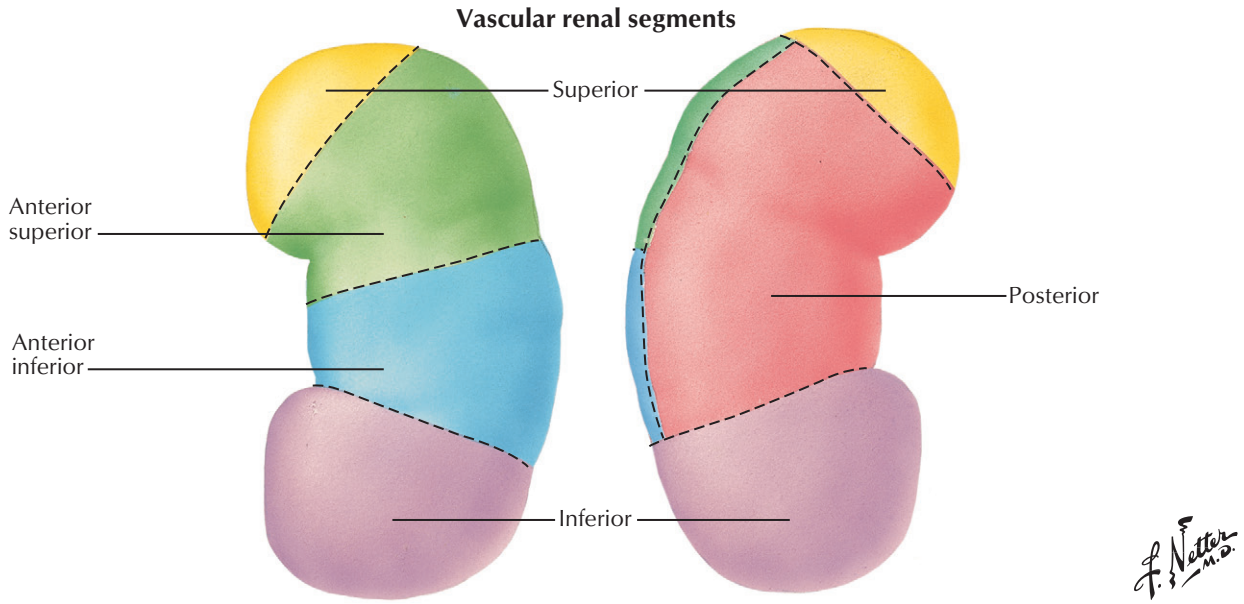


Suprarenal gland and lobulated kidney of infant



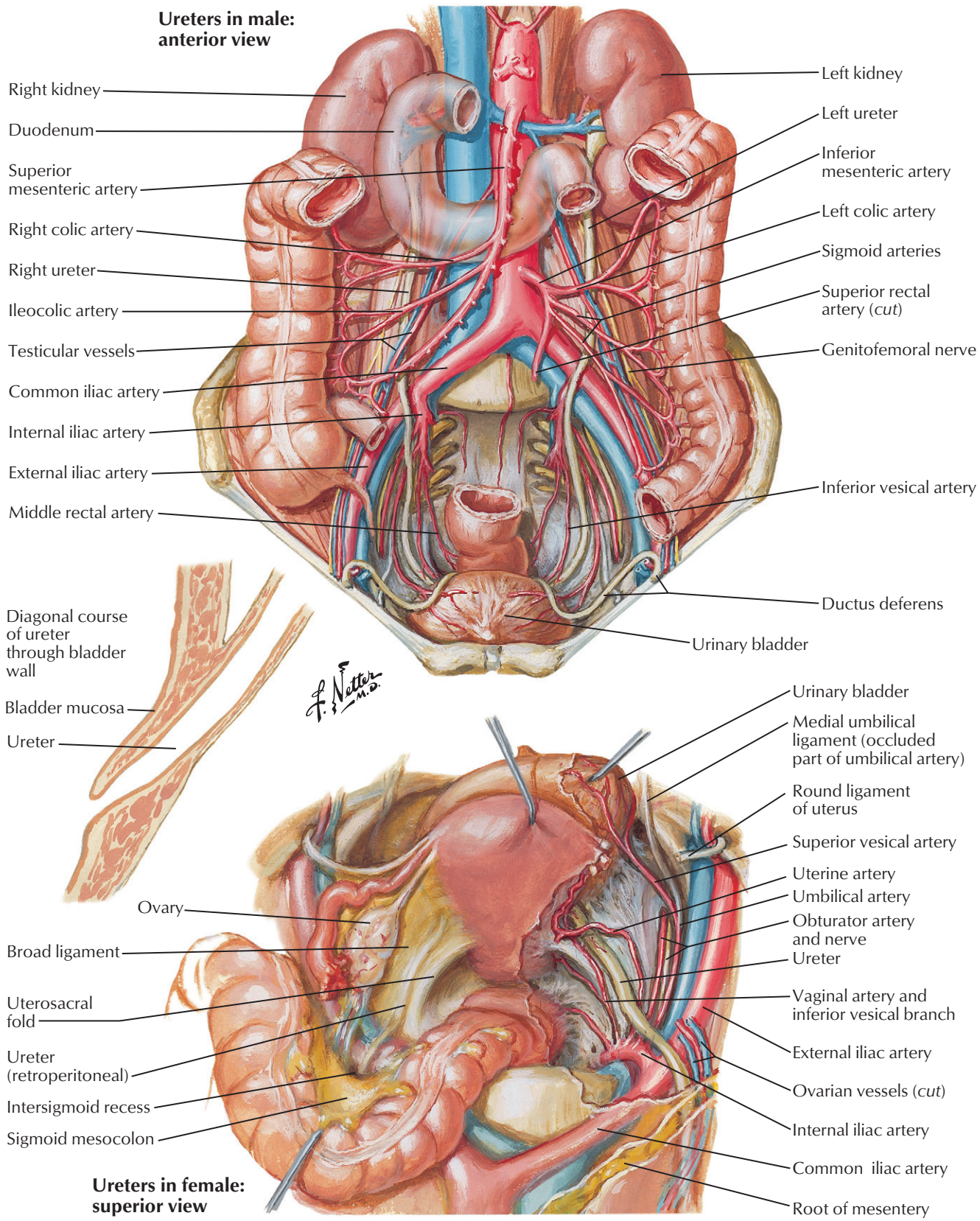
Right kidney sectioned in several planes, exposing parenchyma and renal pelvis

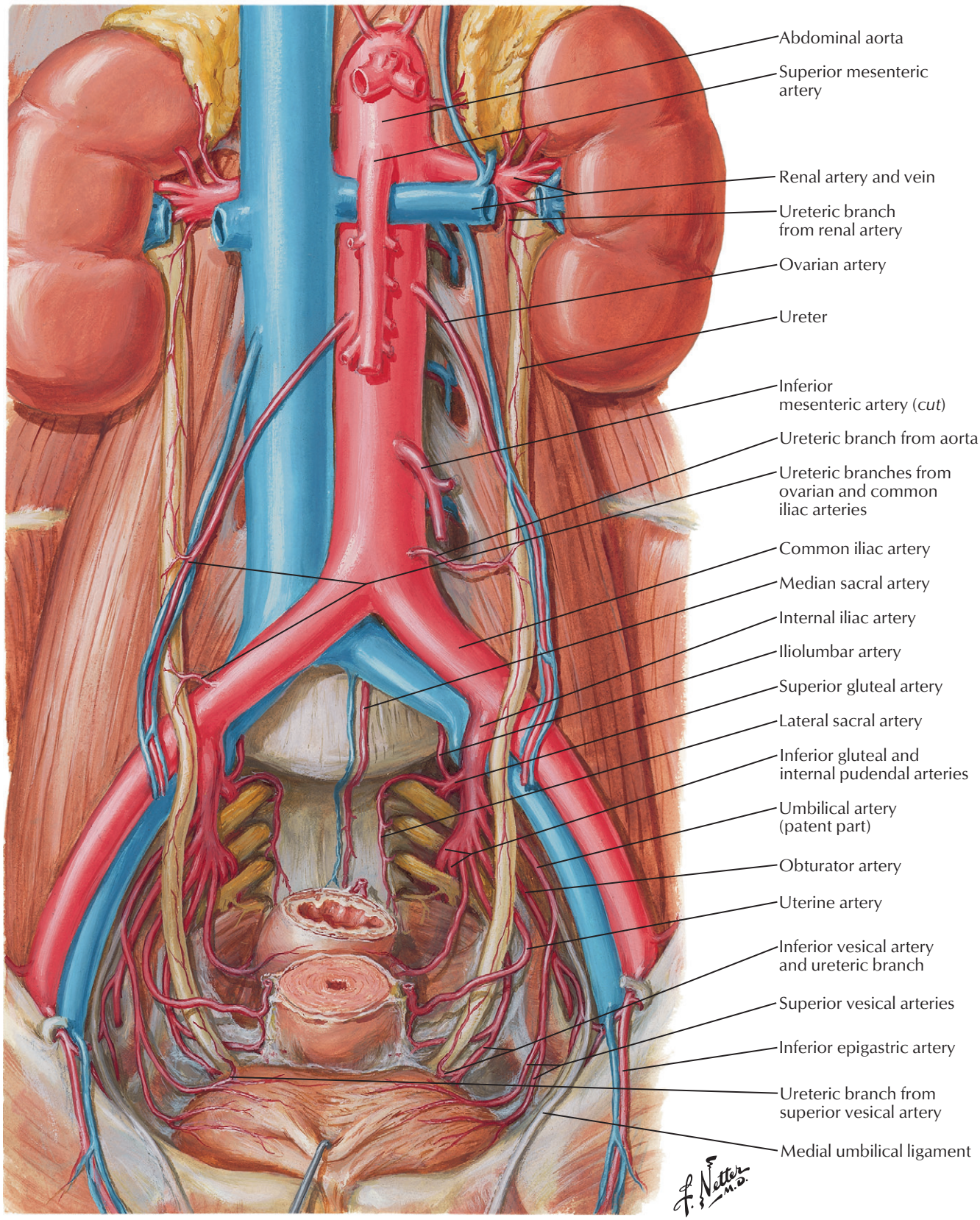


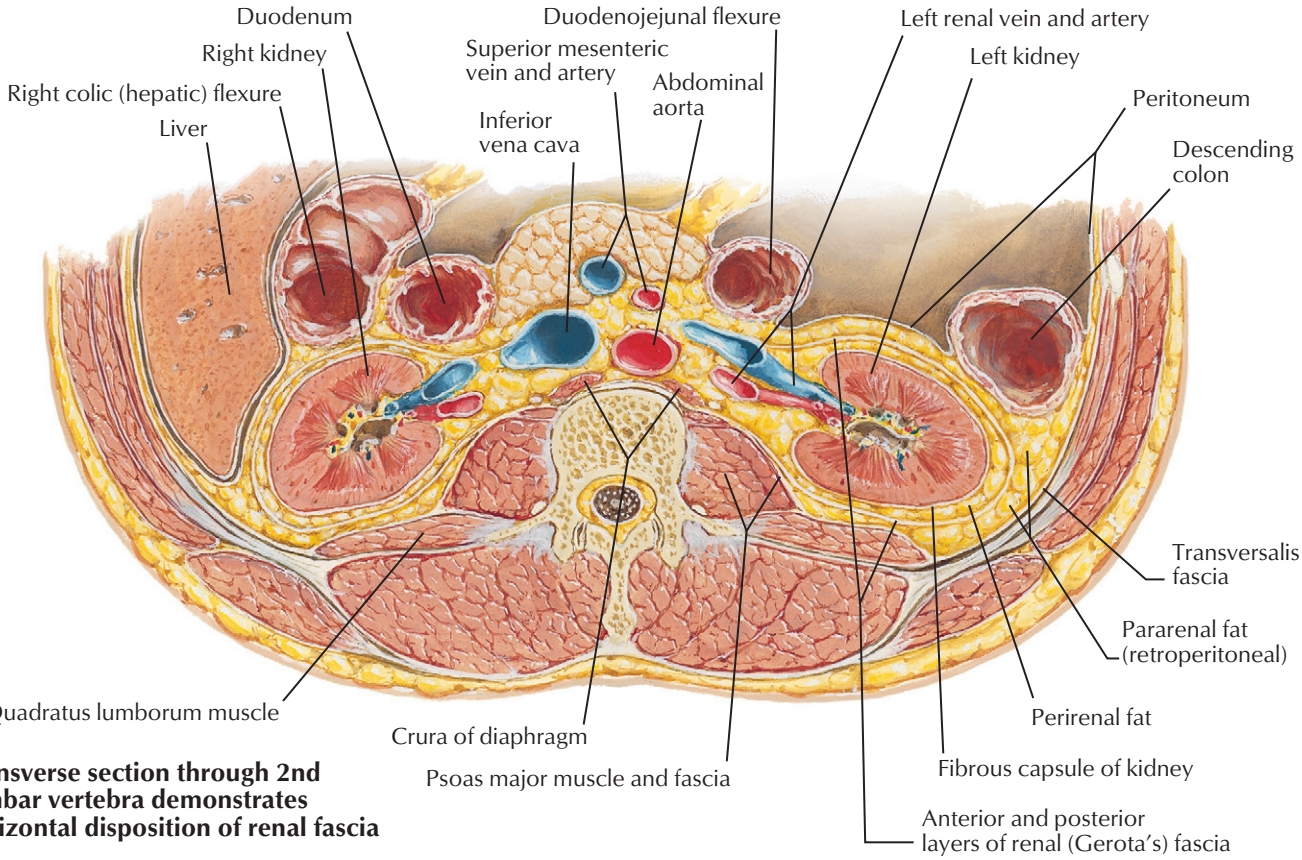


Anterior surface of left kidney

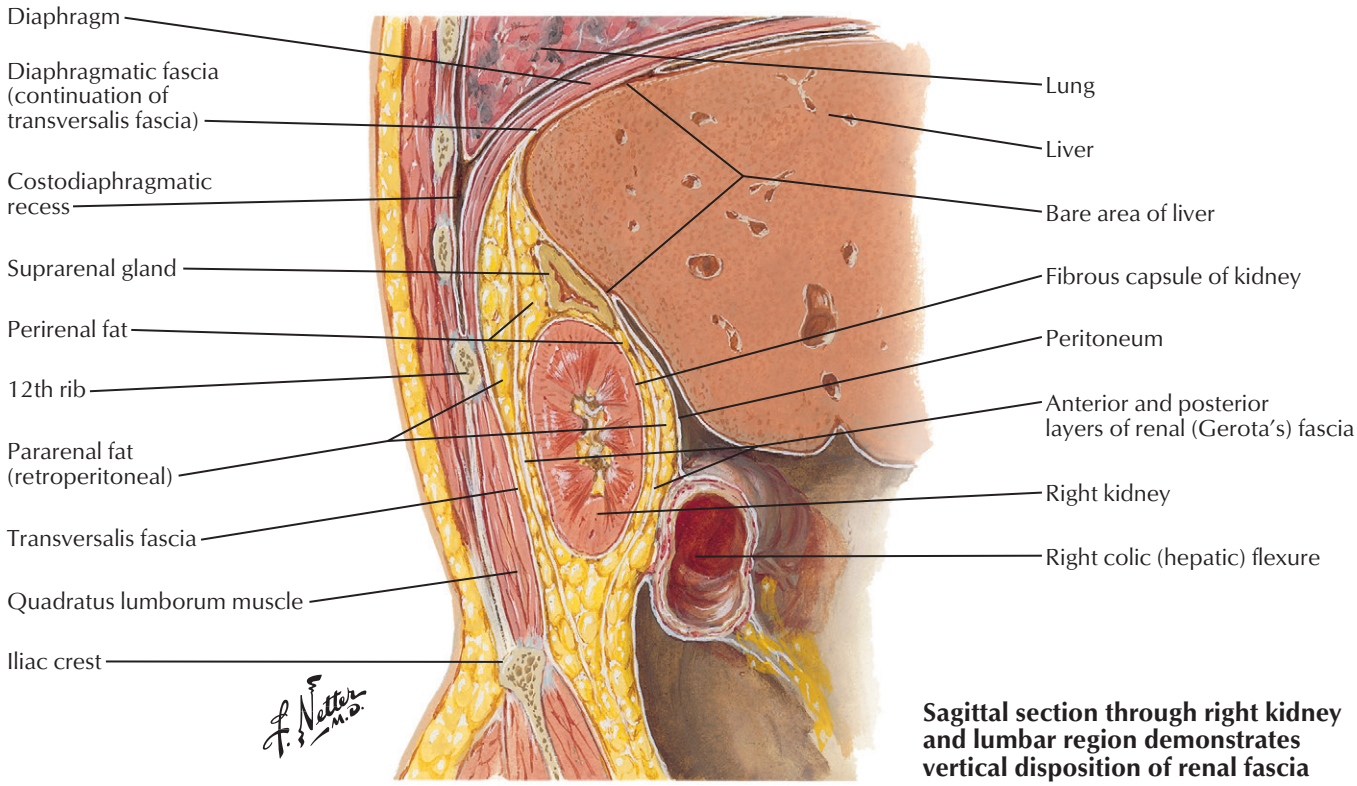
Posterior surface of left kidney


Ureters in male: anterior view
Right kidney
Duodenum
Superior mesenteric artery
Right colic artery
Right ureter
Ileocolic artery
Testicular vessels
Common iliac artery
Internal iliac artery
External iliac artery
Middle rectal artery
Left kidney
Left ureter
Inferior mesenteric artery
Left colic artery
Sigmoid arteries
Superior rectal artery (cut)
Genitofemoral nerve
Inferior vesical artery
Ductus deferens
Urinary bladder
Diagonal course of ureter through bladder wall
Bladder mucosa
Ureter
F. Netter M.D.
Urinary bladder
Medial umbilical ligament (occluded part of umbilical artery)
Round ligament of uterus
Superior vesical artery
Uterine artery
Umbilical artery
Obturator artery and nerve
Ureter
Vaginal artery and inferior vesical branch
External iliac artery
Ovarian vessels (cut)
Internal iliac artery
Common iliac artery
Root of mesentery
Ovary
Broad ligament
Uterosacral fold
Ureter (retroperitoneal)
Intersigmoid recess
Sigmoid mesocolon
Ureters in female: superior view


Abdominal aorta
Superior mesenteric artery
Renal artery and vein
Ureteric branch from renal artery
Ovarian artery
Ureter
Inferior mesenteric artery (*cut*)
Ureteric branch from aorta
Ureteric branches from ovarian and common iliac arteries
Common iliac artery
Median sacral artery
Internal iliac artery
Iliolumbar artery
Superior gluteal artery
Lateral sacral artery
Inferior gluteal and internal pudendal arteries
Umbilical artery (patent part)
Obturator artery
Uterine artery
Inferior vesical artery and ureteric branch
Superior vesical arteries
Inferior epigastric artery
Ureteric branch from superior vesical artery
Medial umbilical ligament



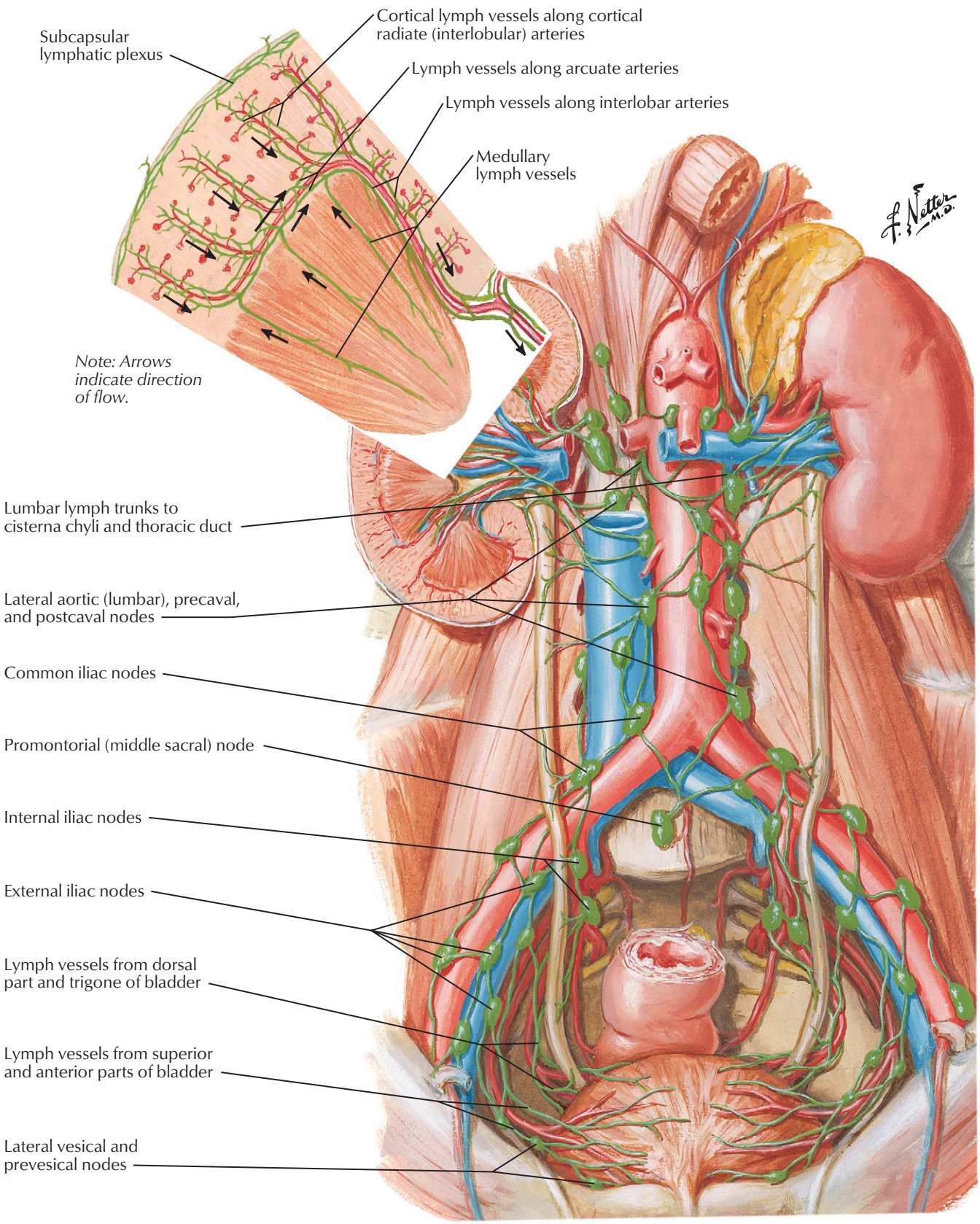
Transverse section through 2nd lumbar vertebra demonstrates horizontal disposition of renal fascia

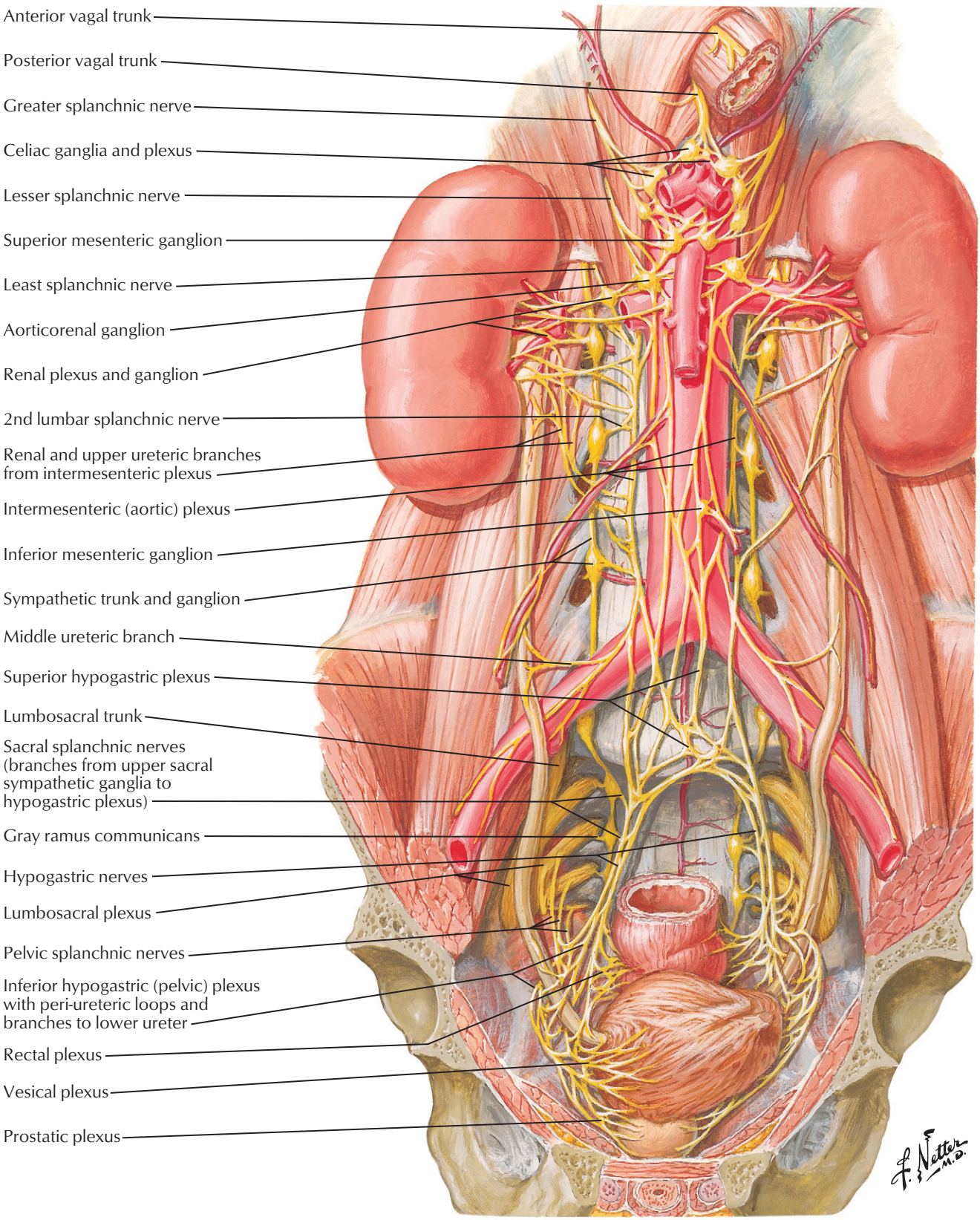


Sagittal section through right kidney and lumbar region demonstrates vertical disposition of renal fascia

Lymph Vessels and Nodes of Kidneys and Urinary Bladder

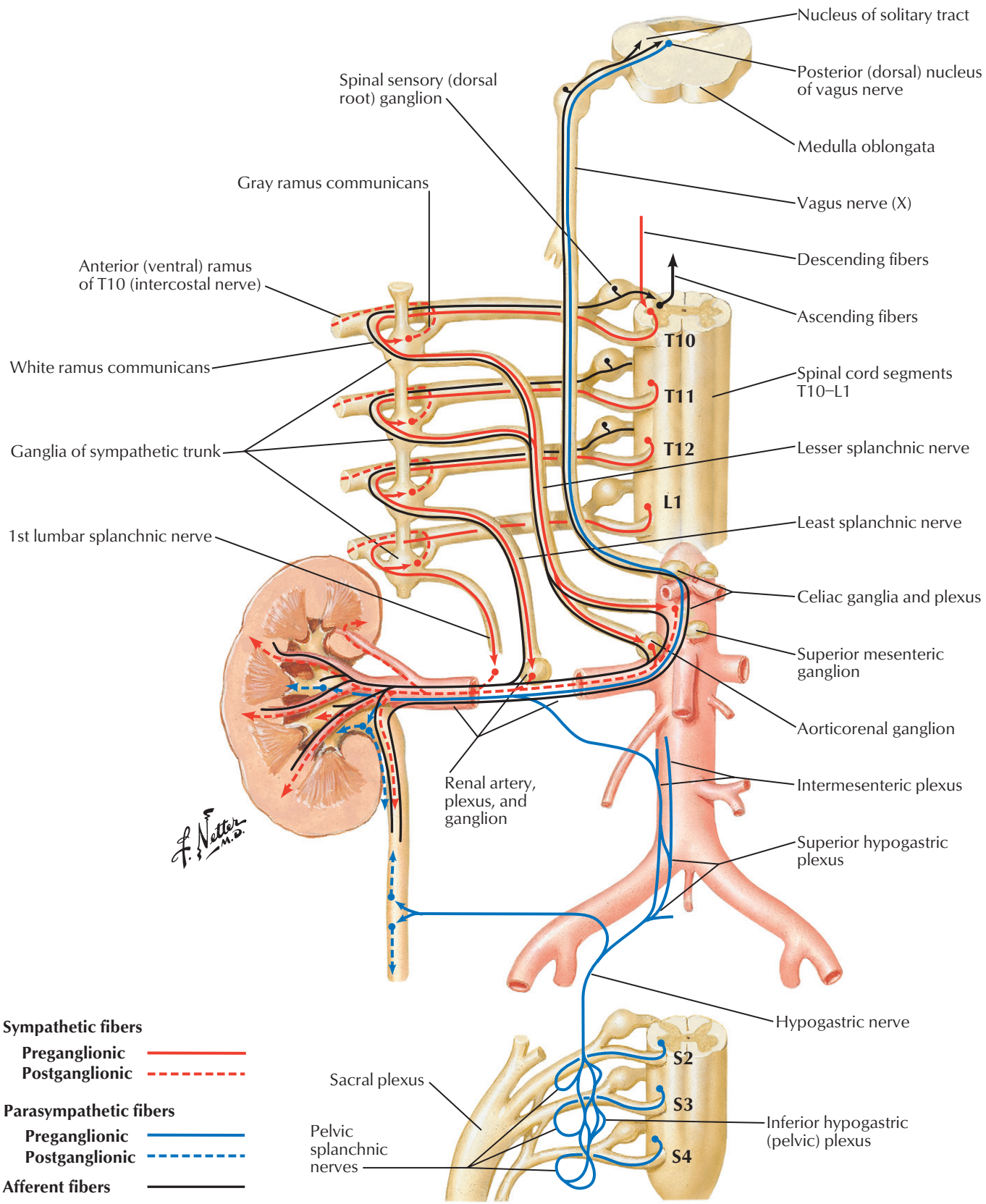
See also Plates 304, 336




Anterior vagal trunk
Posterior vagal trunk
Greater splanchnic nerve
Celiac ganglia and plexus
Lesser splanchnic nerve
Superior mesenteric ganglion
Least splanchnic nerve
Aorticorenal ganglion
Renal plexus and ganglion
2nd lumbar splanchnic nerve
Renal and upper ureteric branches from intermesenteric plexus
Intermesenteric (aortic) plexus
Inferior mesenteric ganglion
Sympathetic trunk and ganglion
Middle ureteric branch
Superior hypogastric plexus
Lumbosacral trunk
Sacral splanchnic nerves (branches from upper sacral sympathetic ganglia to hypogastric plexus)
Gray ramus communicans
Hypogastric nerves
Lumbosacral plexus
Pelvic splanchnic nerves
Inferior hypogastric (pelvic) plexus with peri-ureteric loops and branches to lower ureter
Rectal plexus
Vesical plexus
Prostatic plexus
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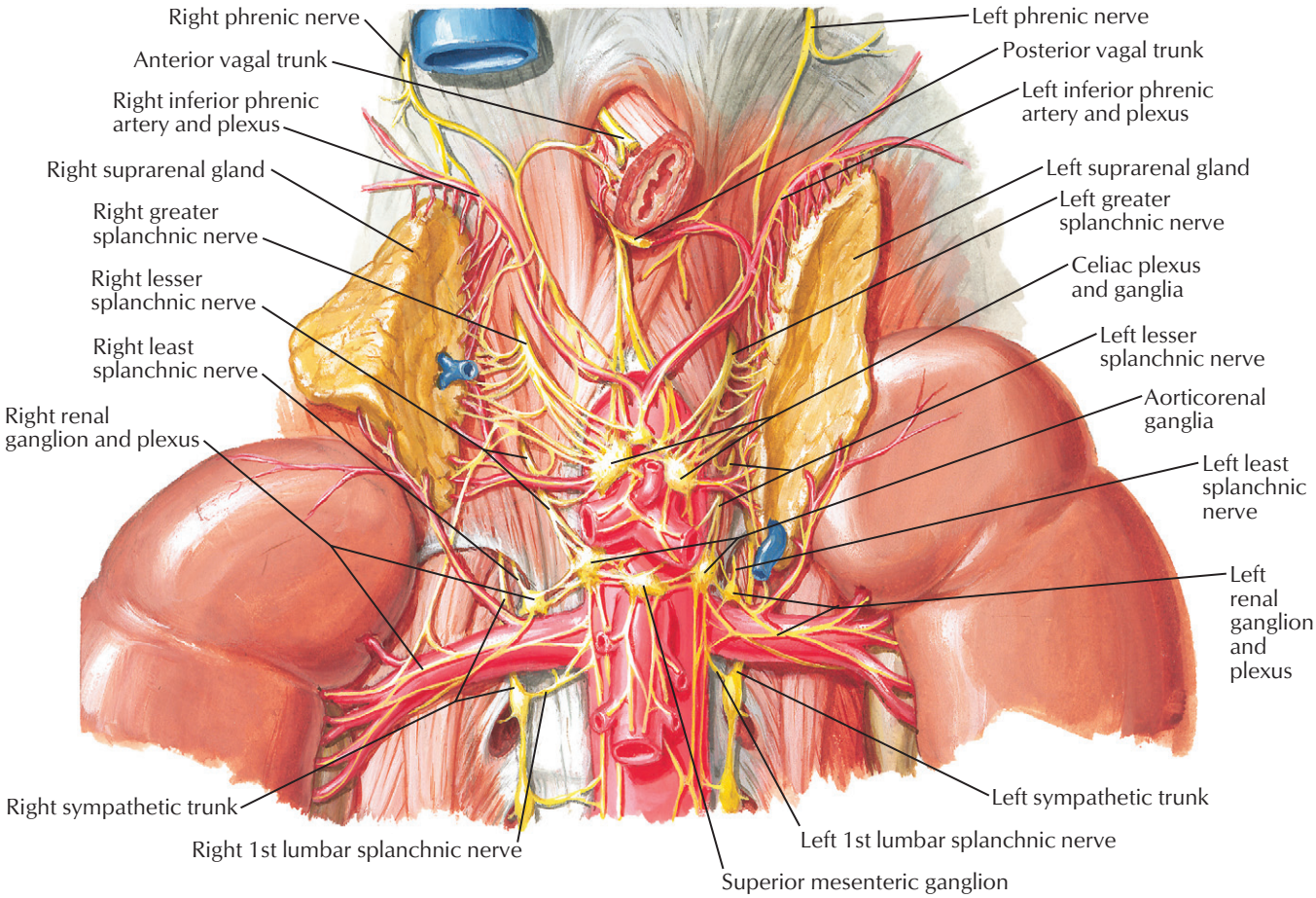
Autonomic Innervation of Kidneys and Upper Ureters: Schema

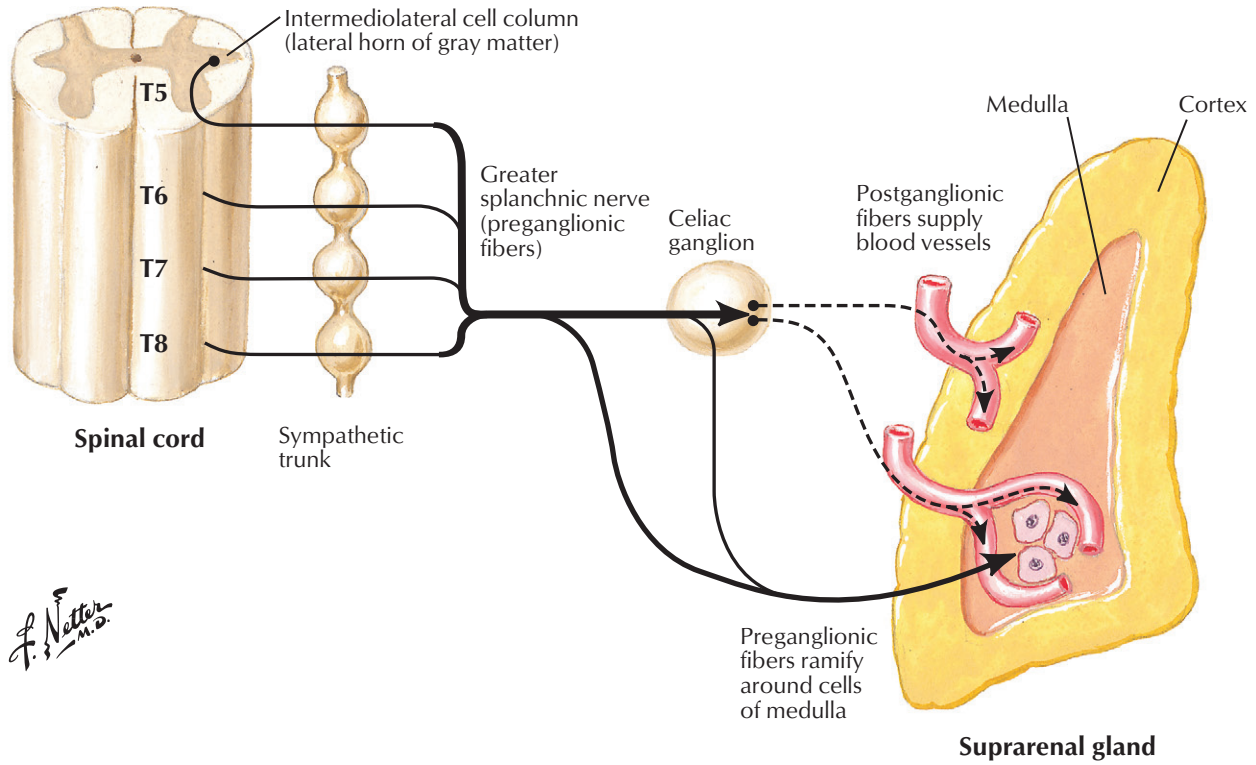
See also Plates 163, 164, 395

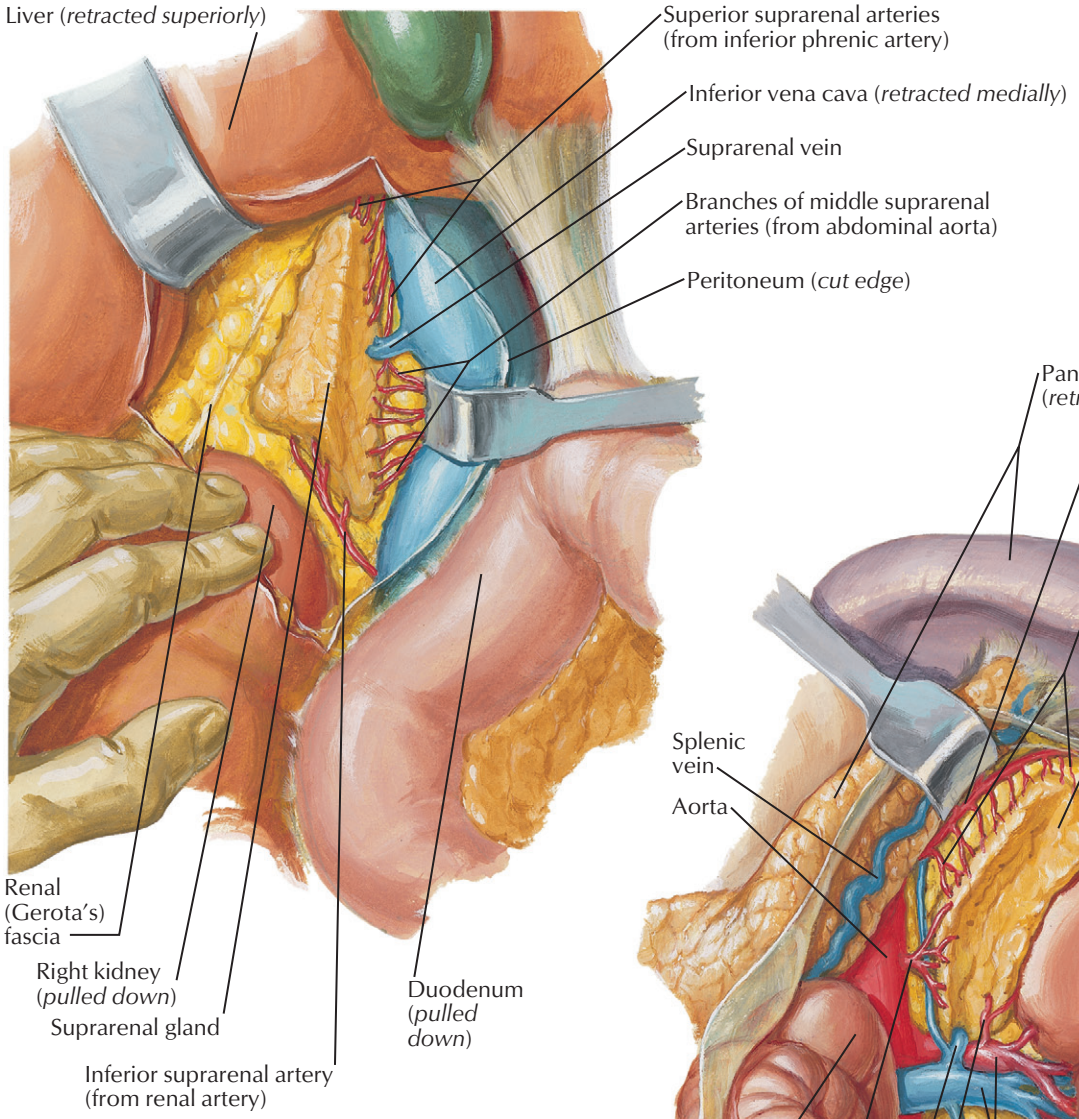


Autonomic Nerves of Suprarenal Glands: Dissection and Schema

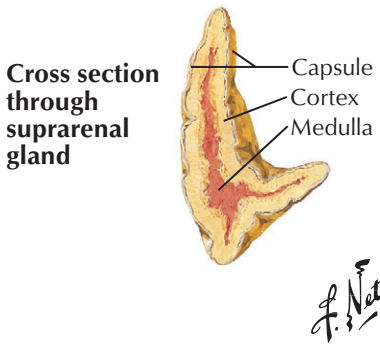
See also Plates 163, 164



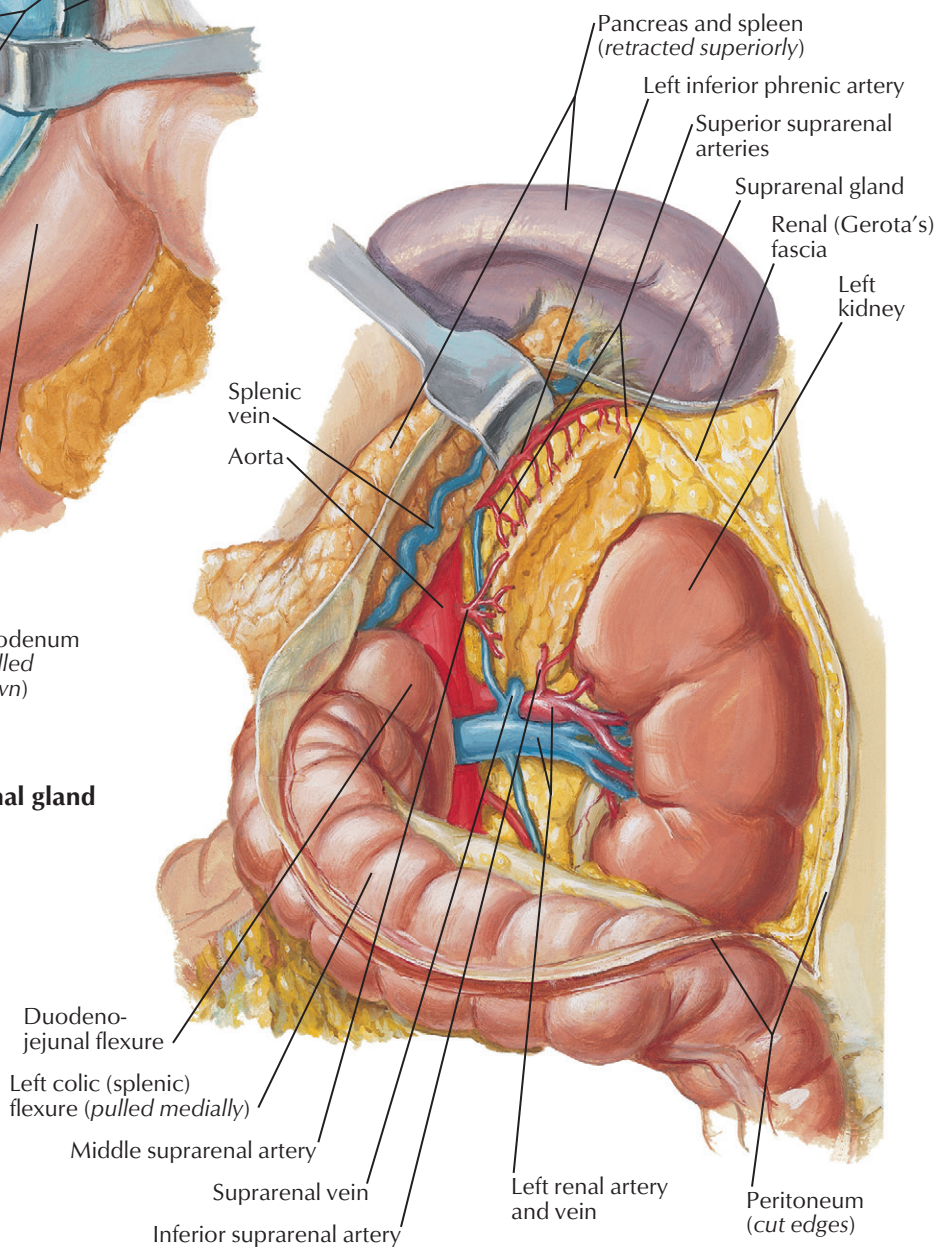




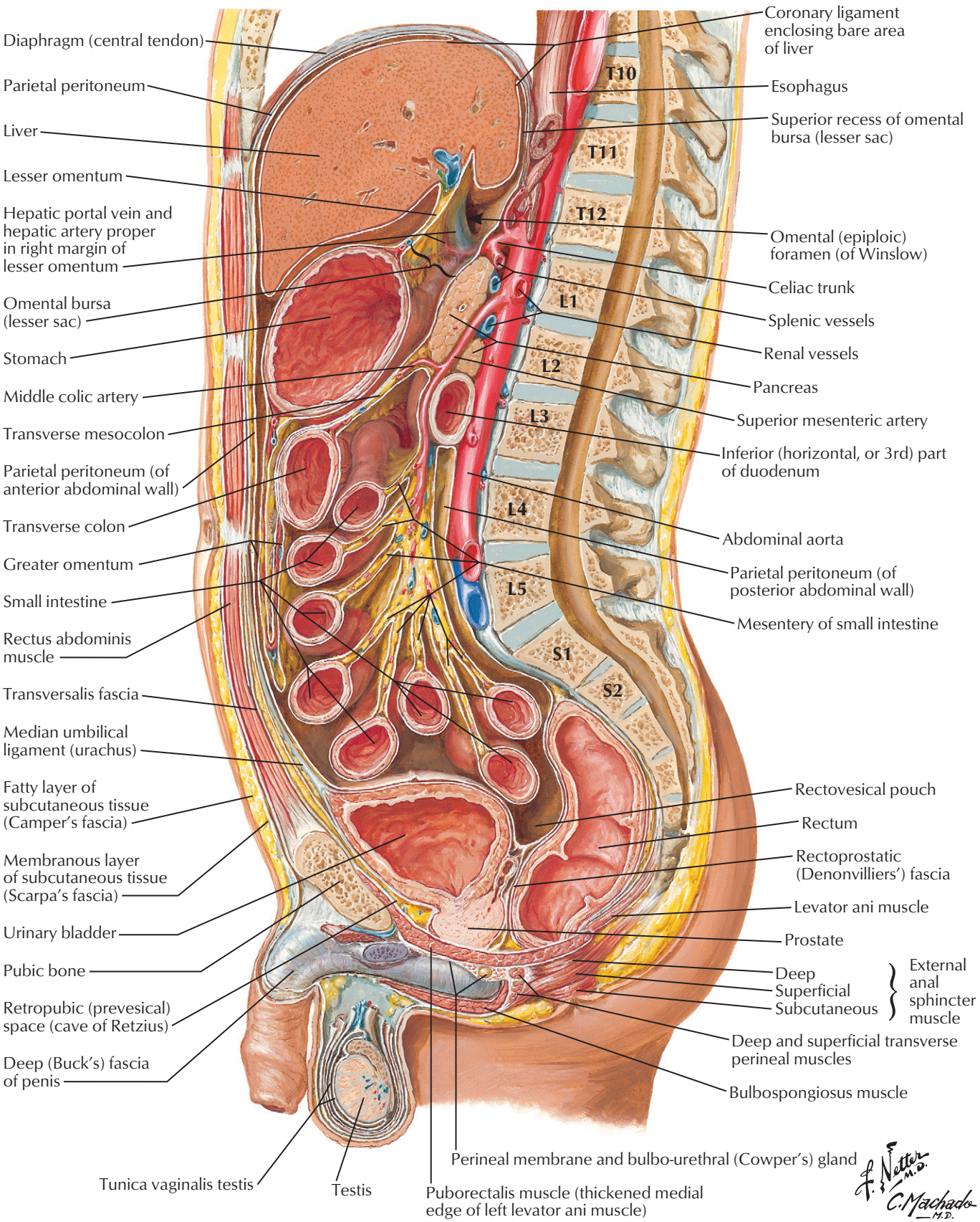
Abdominal exposure of right suprarenal gland



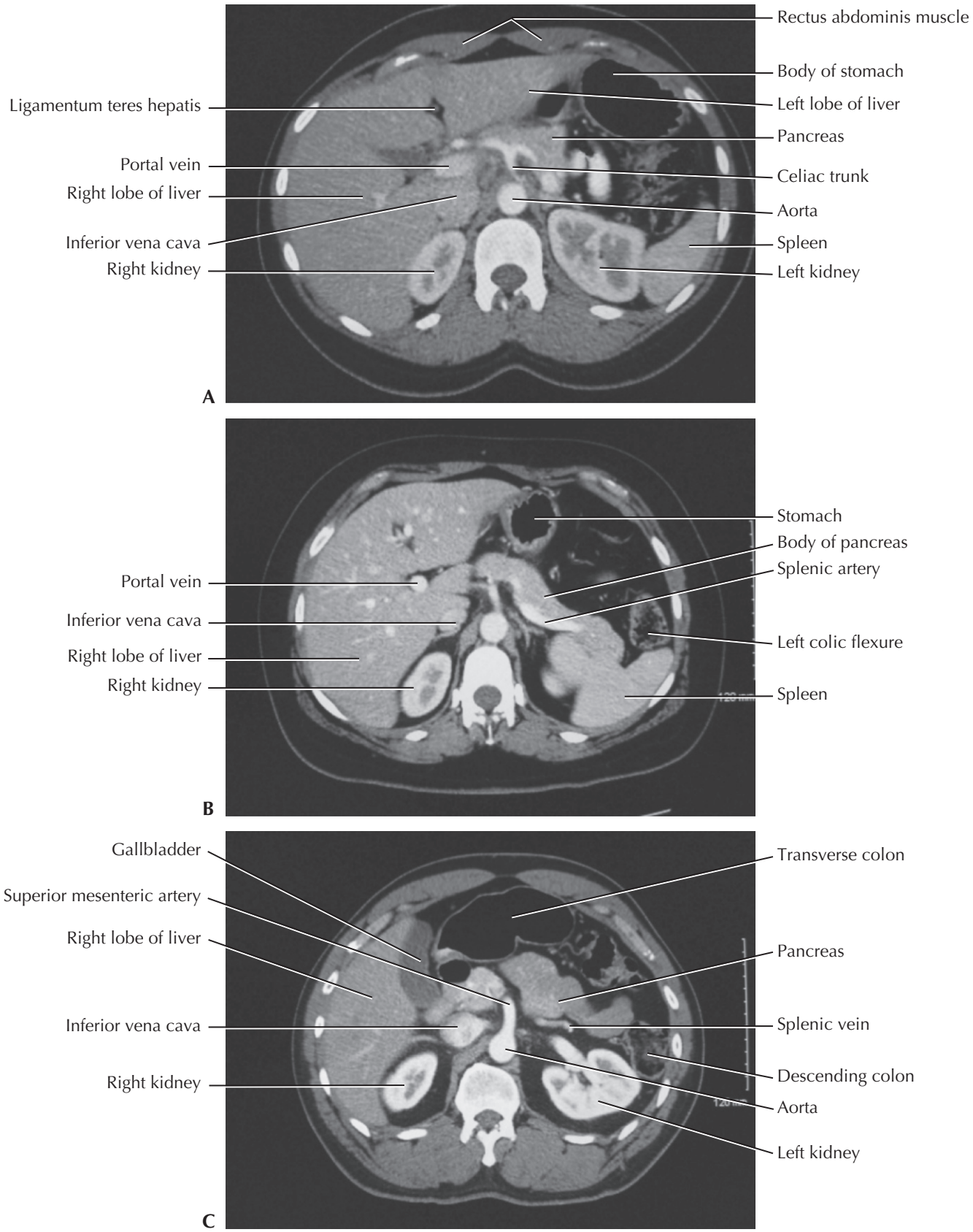
Cross section through suprarenal gland



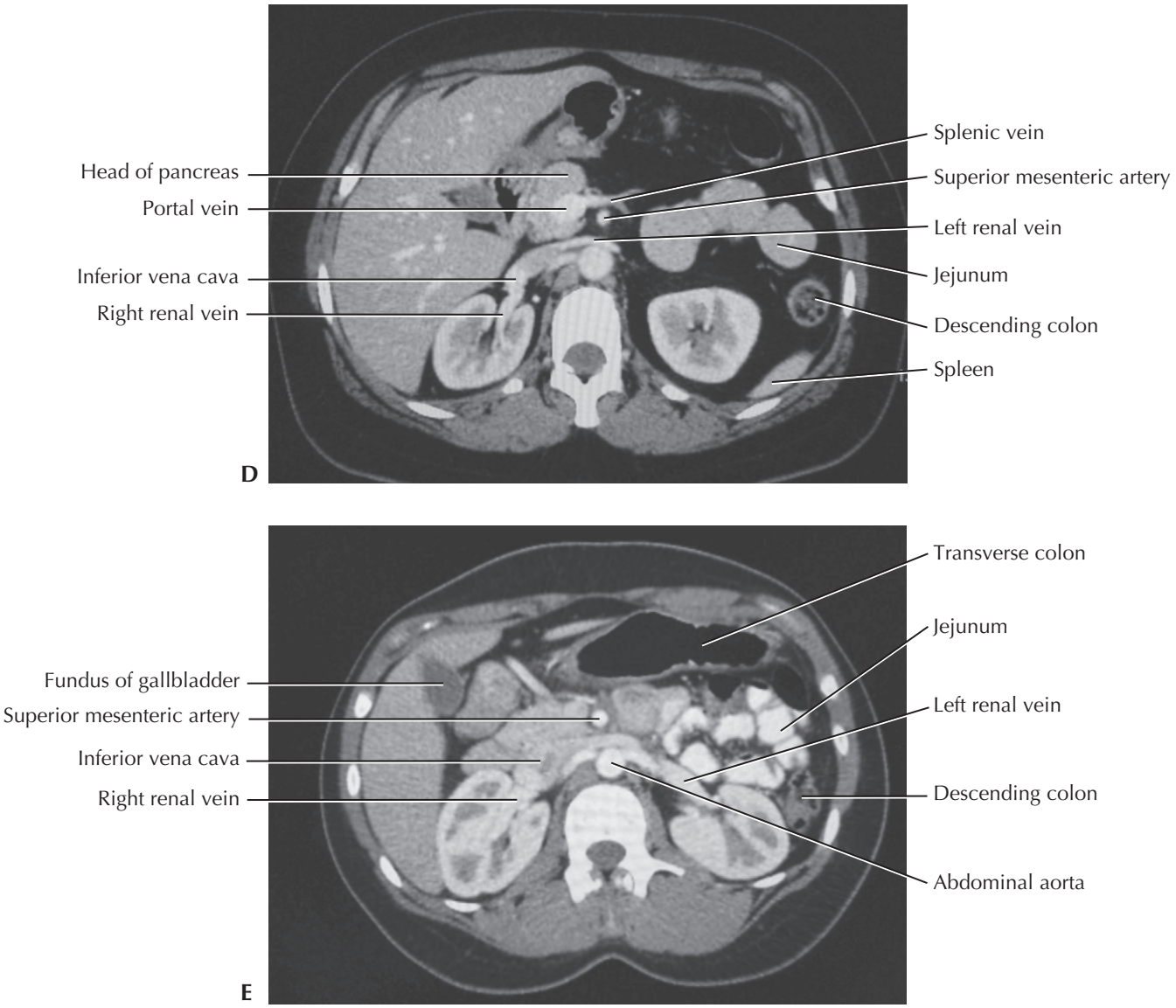
Abdominal exposure of left suprarenal gland


Diaphragm (central tendon)
Parietal peritoneum
Liver
Lesser omentum
Hepatic portal vein and hepatic artery proper in right margin of lesser omentum
Omental bursa (lesser sac)
Stomach
Middle colic artery
Transverse mesocolon
Parietal peritoneum (of anterior abdominal wall)
Transverse colon
Greater omentum
Small intestine
Rectus abdominis muscle
Transversalis fascia
Median umbilical ligament (urachus)
Fatty layer of subcutaneous tissue (Camper's fascia)
Membranous layer of subcutaneous tissue (Scarpa's fascia)
Urinary bladder
Pubic bone
Retropubic (prevesical) space (cave of Retzius)
Deep (Buck's) fascia of penis
Tunica vaginalis testis
Testis
Puborectalis muscle (thickened medial edge of left levator ani muscle)
Perineal membrane and bulbo-urethral (Cowper's) gland
Bulbospongiosus muscle
Deep and superficial transverse perineal muscles
Deep
Superficial
Subcutaneous
External anal sphincter muscle
Rectovesical pouch
Rectum
Rectoprostatic (Denonvilliers') fascia
Levator ani muscle
Prostate
Coronary ligament enclosing bare area of liver
Esophagus
Superior recess of omental bursa (lesser sac)
Omental (epiploic) foramen (of Winslow)
Celiac trunk
Splenic vessels
Renal vessels
Pancreas
Superior mesenteric artery
Inferior (horizontal, or 3rd) part of duodenum
Abdominal aorta
Parietal peritoneum (of posterior abdominal wall)
Mesentery of small intestine
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
F. Netter M.D.
C. Machado M.D.

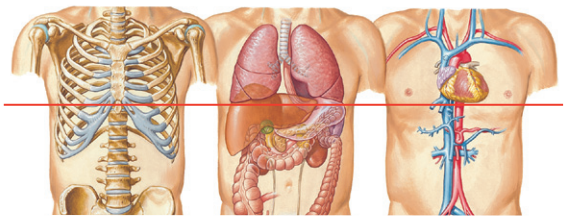
Series of abdominal axial CT images from superior (A) to inferior (C)

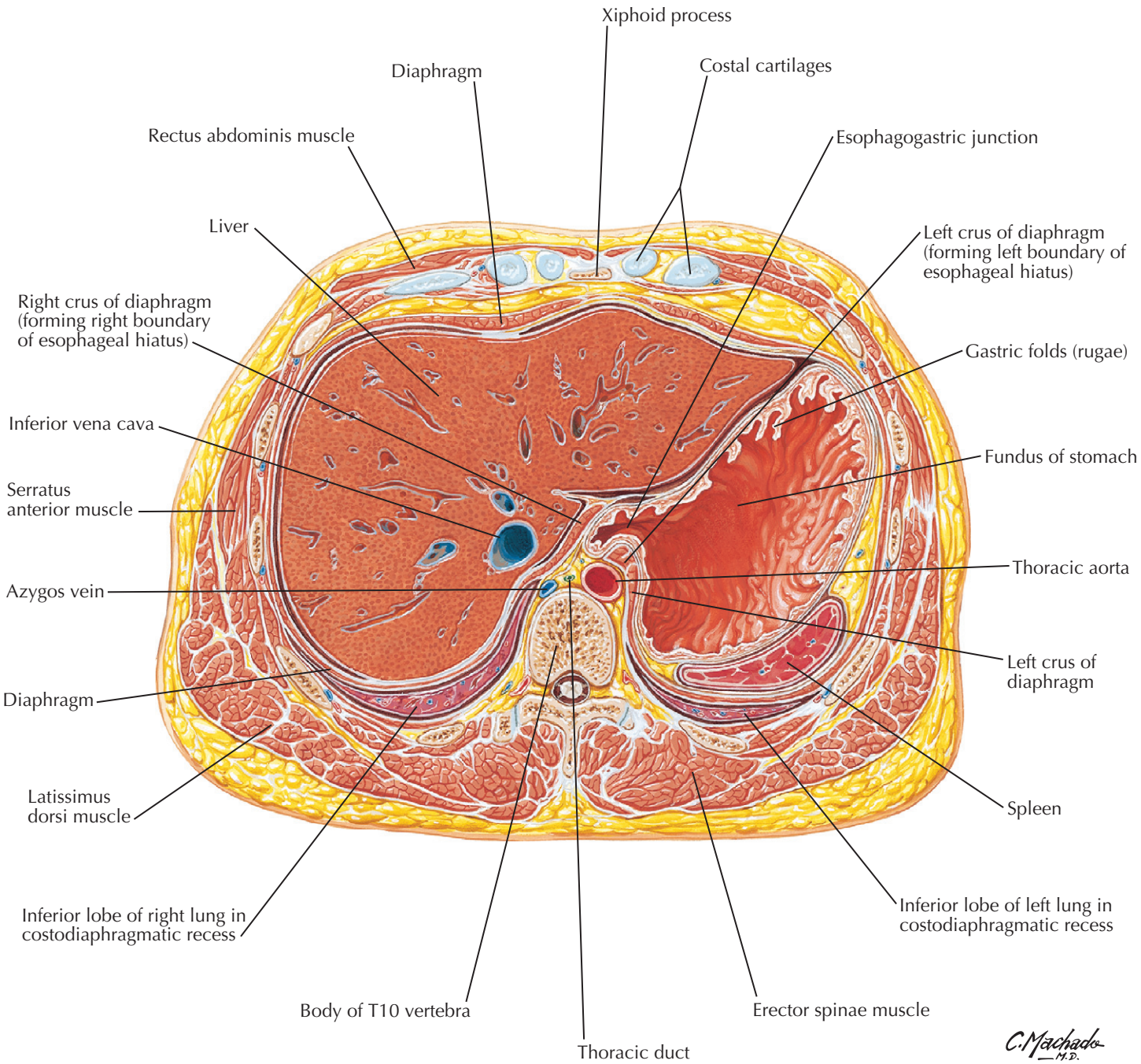


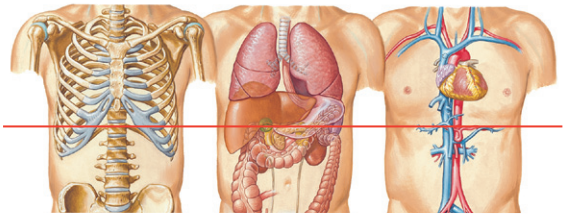
Series of abdominal axial CT images from superior (D) to inferior (E)

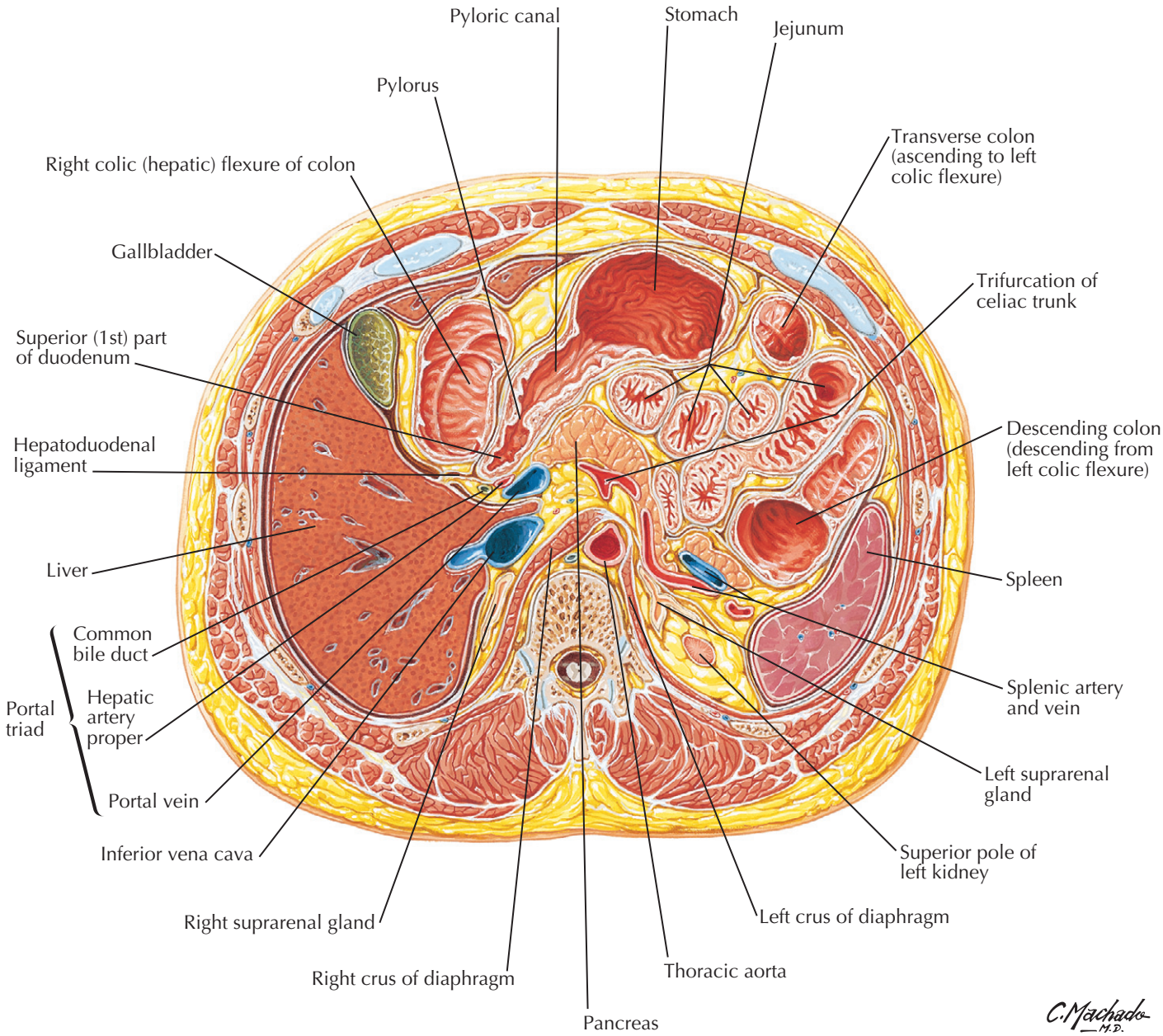


Cross Section at T10, Esophagogastric Junction

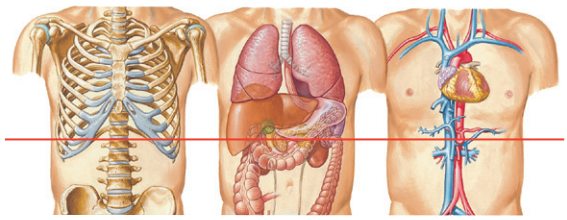


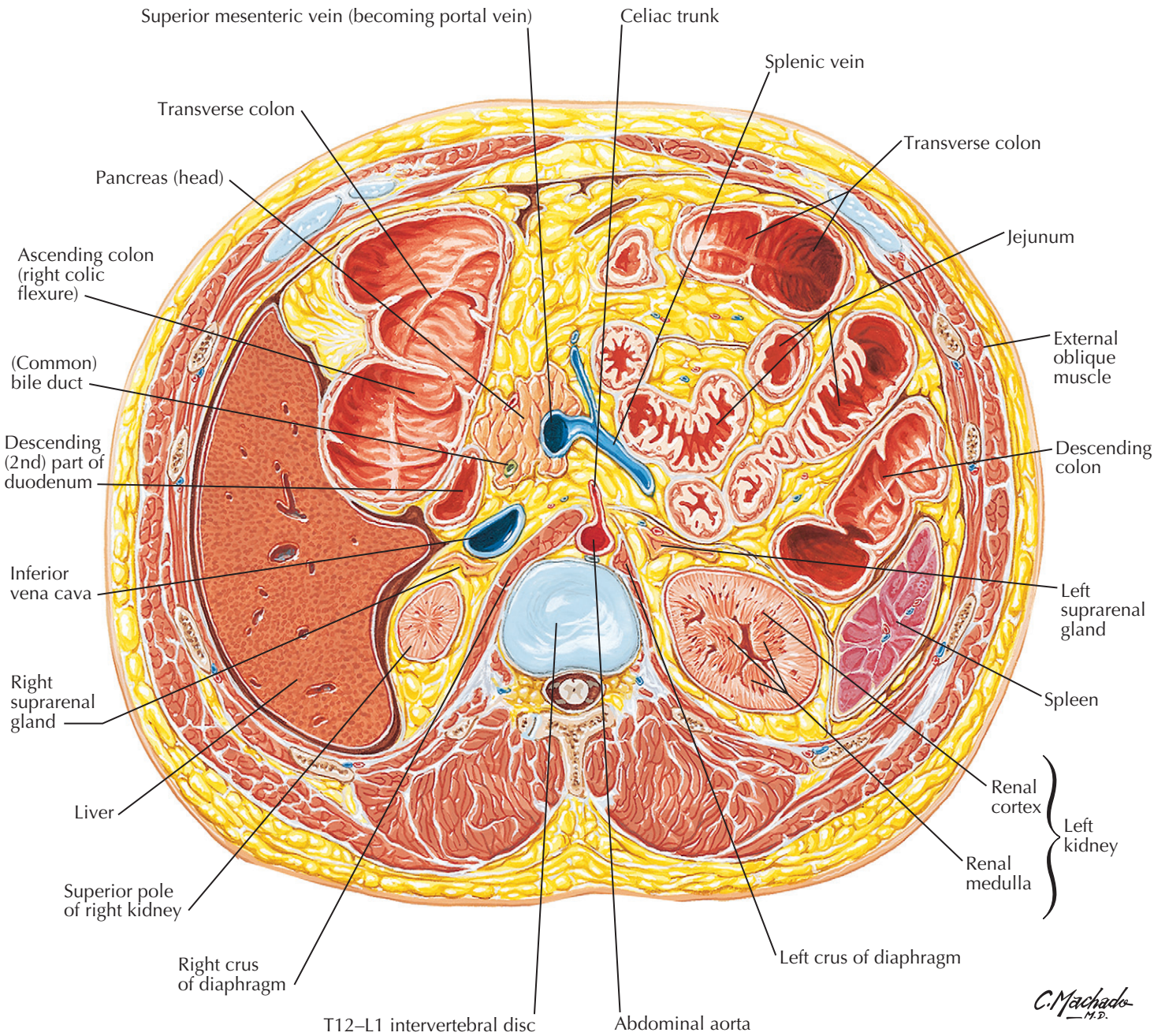


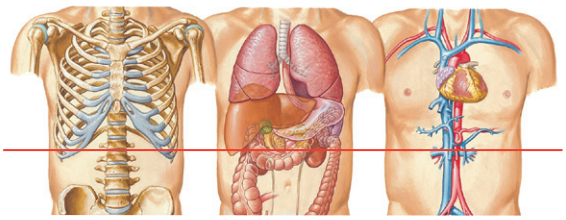


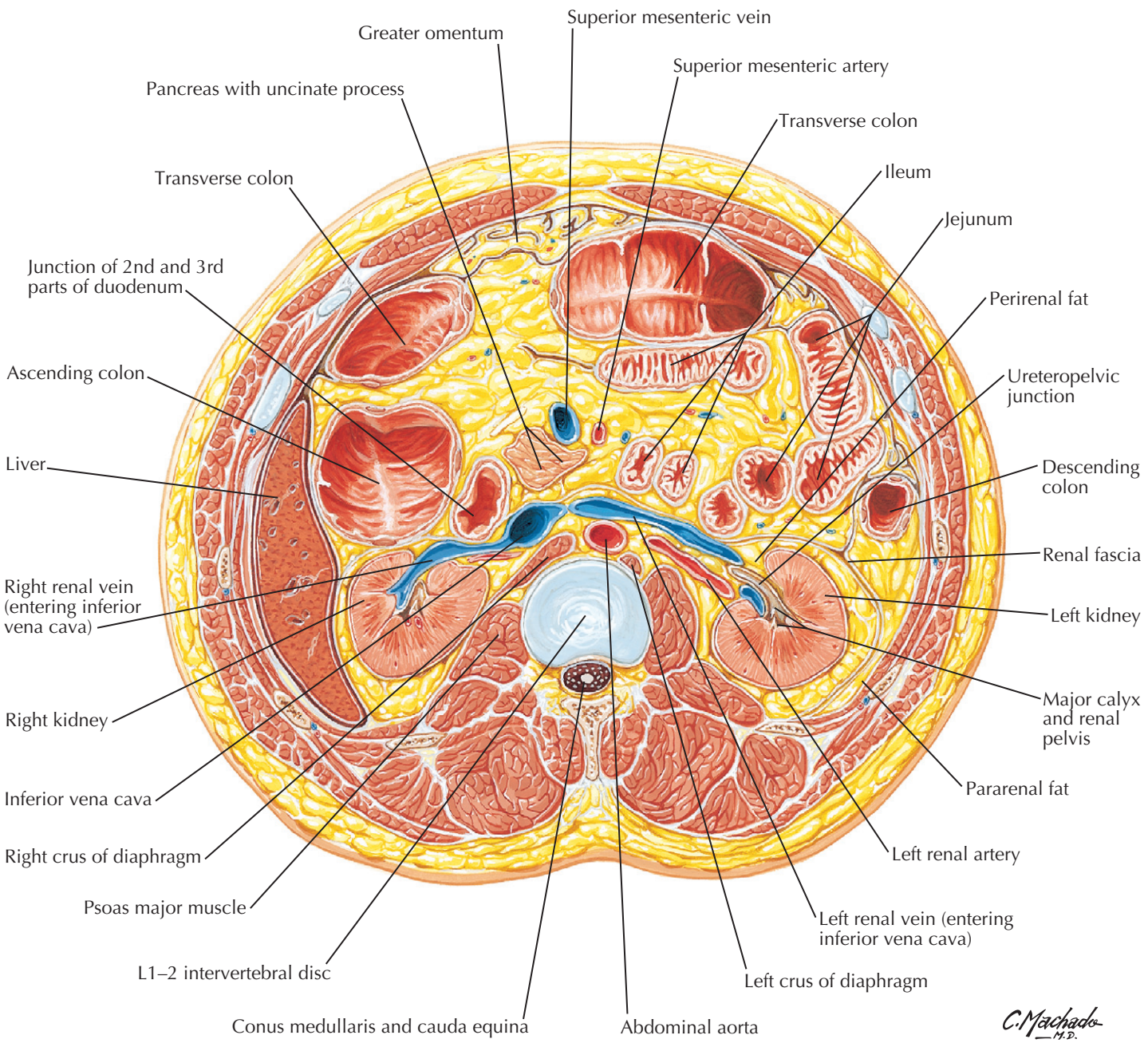

Pyloric canal
Stomach
Jejunum
Pylorus
Transverse colon (ascending to left colic flexure)
Right colic (hepatic) flexure of colon
Gallbladder
Trifurcation of celiac trunk
Superior (1st) part of duodenum
Descending colon (descending from left colic flexure)
Hepatoduodenal ligament
Liver
Spleen
Common bile duct
Portal triad
Hepatic artery proper
Splenic artery and vein
Portal vein
Left suprarenal gland
Inferior vena cava
Superior pole of left kidney
Right suprarenal gland
Left crus of diaphragm
Right crus of diaphragm
Thoracic aorta
Pancreas
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Cross Section at T12–L1, Intervertebral Disc

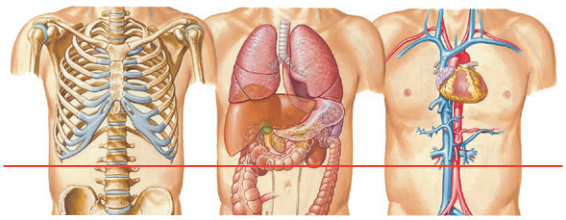


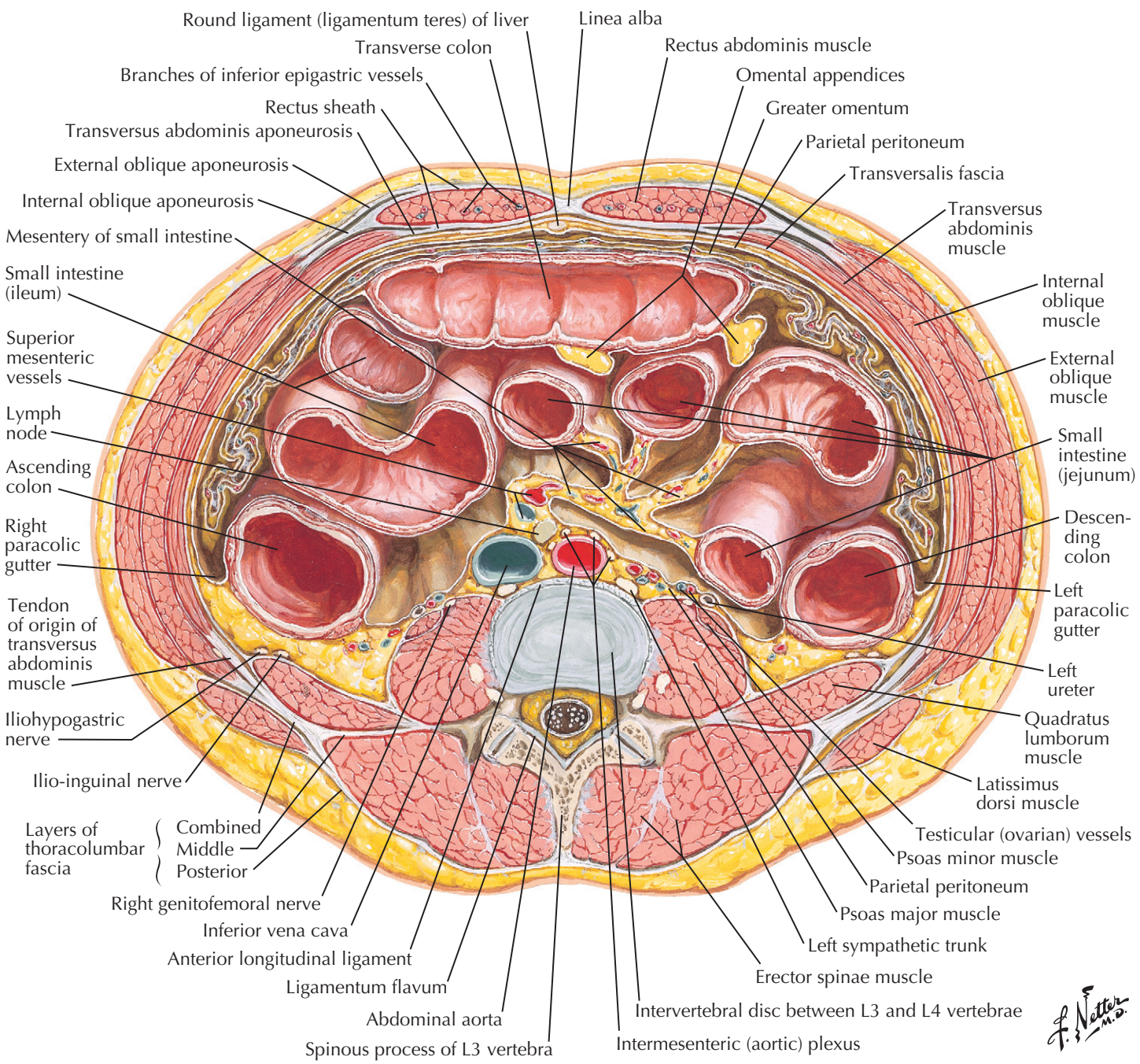





Greater omentum
Superior mesenteric vein
Superior mesenteric artery
Pancreas with uncinate process
Transverse colon
Transverse colon
Ileum
Jejunum
Junction of 2nd and 3rd parts of duodenum
Perirenal fat
Ascending colon
Ureteropelvic junction
Liver
Descending colon
Renal fascia
Right renal vein (entering inferior vena cava)
Left kidney
Right kidney
Major calyx and renal pelvis
Pararenal fat
Inferior vena cava
Right crus of diaphragm
Left renal artery
Psoas major muscle
Left renal vein (entering inferior vena cava)
L1–2 intervertebral disc
Left crus of diaphragm
Conus medullaris and cauda equina
Abdominal aorta
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Cross Section at L3–4

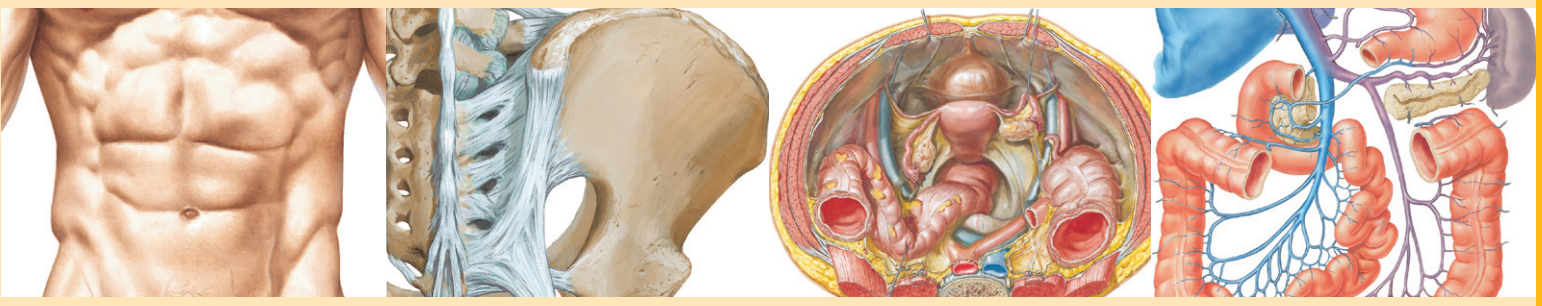




MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Diaphragm	Xiphoid process, lower six costal cartilages, L1–L3 vertebrae	Converges into central tendon	Phrenic nerve	Draws central tendon down and forward during inspiration	Pericardiacophrenic, musculophrenic, superior and inferior phrenic arteries	Posterior abdominal wall
External oblique	External surfaces of ribs 5–12	Linea alba, pubic tubercle, anterior half of iliac crest	Ventral rami of six inferior thoracic nerves	Compresses and supports abdominal viscera, flexes and rotates trunk	Superior and inferior epigastric arteries	Abdominal wall
Iliacus	Superior 2/3 iliac fossa, ala of sacrum, anterior sacro-iliac ligaments	Lesser trochanter of femur and shaft inferior to it, and to psoas major tendon	Femoral nerve	Flexes hip and stabilizes hip joint; acts with psoas major	Iliac branches of iliolumbar artery	Posterior abdominal wall
Internal oblique	Thoracolumbar fascia, anterior 2/3 of iliac crest, lateral half of inguinal ligament	Inferior borders of ribs 10–12, linea alba, pubis via conjoint tendon	Ventral rami of six inferior thoracic and first lumbar nerves	Compresses and supports abdominal viscera, flexes and rotates trunk	Superior and inferior epigastric and deep circumflex iliac arteries	Abdominal wall
Psoas major	Transverse processes of lumbar vertebrae, sides of bodies of T12–L5 vertebrae, intervening intervertebral discs	Lesser trochanter of femur	Ventral rami of first four lumbar nerves	Acting superiorly with iliacus, flexes hip; acting inferiorly, flexes vertebral column laterally; used to balance trunk in sitting position; acting inferiorly with iliacus, flexes trunk	Lumbar branches of iliolumbar artery	Posterior abdominal wall
Psoas minor	Vertebral margins of T12–L1 vertebrae, corresponding intervertebral disc	Pectineal line, iliopectineal eminence	Ventral rami of first lumbar nerve	Flexes pelvis on vertebral column	Lumbar branch of iliolumbar artery	Posterior abdominal wall
Pyramidalis	Body of pubis, anterior to rectus abdominis	Linea alba	Iliohypogastric nerve	Tenses linea alba	Inferior epigastric artery	Abdominal wall
Quadratus lumborum	Medial half of inferior border of 12th rib, tips of lumbar transverse processes	Iliolumbar ligament, internal lip of iliac crest	Ventral rami of T12 and first four lumbar nerves	Extends and laterally flexes vertebral column, fixes 12th rib during inspiration	Iliolumbar artery	Posterior abdominal wall
Rectus abdominis	Pubic symphysis, pubic crest	Xiphoid process, costal cartilages 5–7	Ventral rami of six inferior thoracic nerves	Flexes trunk, compresses abdominal viscera	Superior and interior epigastric arteries	Abdominal wall
Transversus abdominis	Internal surfaces of costal cartilages 7–12, thoracolumbar fascia, iliac crest, lateral third of inguinal ligament	Linea alba with aponeurosis of internal oblique, pubic crest, and pecten pubis via conjoint tendon	Ventral rami of six inferior thoracic and first lumbar nerves	Compresses and supports abdominal viscera	Deep circumflex iliac and inferior epigastric arteries	Abdominal wall

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

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Section 5

5 PELVIS AND PERINEUM

Topographic Anatomy
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329 Pelvis and Perineum: Surface Anatomy

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333 Bones and Ligaments of Pelvis
334 Bones and Ligaments of Pelvis (continued)

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336 Pelvic Diaphragm: Female (continued)
337 Pelvic Diaphragm: Female (continued)
338 Pelvic Diaphragm: Male
339 Pelvic Diaphragm: Male (continued)
340 Pelvic Viscera and Perineum: Female
341 Pelvic Contents: Female
342 Pelvic Viscera: Female
343 Endopelvic Fascia and Potential Spaces
344 Pelvic Viscera and Perineum: Male
345 Pelvic Contents: Male

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354 Female Perineum and External Genitalia (Pudendum or Vulva)

355 Female Perineum (Superficial Dissection)

356 Female Perineum and Deep Perineum

357 Female Perineal Spaces

Perineum and External Genitalia: Male

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359 Male Perineum and External Genitalia (Deeper Dissection)

360 Penis

361 Male Perineal Spaces

362 Prostate and Seminal Vesicles

363 Urethra

364 Descent of Testis

365 Scrotum and Contents

Homologues of Genitalia

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366 Homologues of External Genitalia

367 Homologues of Internal Genitalia

Testis, Epididymis, and Ductus Deferens

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368 Testis, Epididymis, and Ductus Deferens

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371 Rectum and Anal Canal

372 Anorectal Musculature

373 External Anal Sphincter Muscle: Perineal Views

374 Actual and Potential Perineopelvic Spaces

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375 Pelvic Scans: Sagittal CT Images

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377 Veins of Rectum and Anal Canal: Female

378 Arteries and Veins of Pelvic Organs: Female

379 Arteries and Veins of Testis

380 Arteries of Pelvis: Female

381 Arteries and Veins of Pelvis: Male

382 Arteries and Veins of Perineum and Uterus

383 Arteries and Veins of Perineum: Male

384 Lymph Vessels and Nodes of Pelvis and Genitalia: Female

385 Lymph Vessels and Nodes of Perineum: Female

386 Lymph Vessels and Nodes of Pelvis and Genitalia: Male

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388 Nerves of Pelvic Viscera: Male

389 Nerves of Perineum: Male

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391 Nerves of Perineum and External Genitalia: Female

392 Neuropathways in Parturition

393 Innervation of Female Reproductive Organs: Schema

394 Innervation of Male Reproductive Organs: Schema

395 Innervation of Urinary Bladder and Lower Ureter: Schema

Cross-Sectional Anatomy

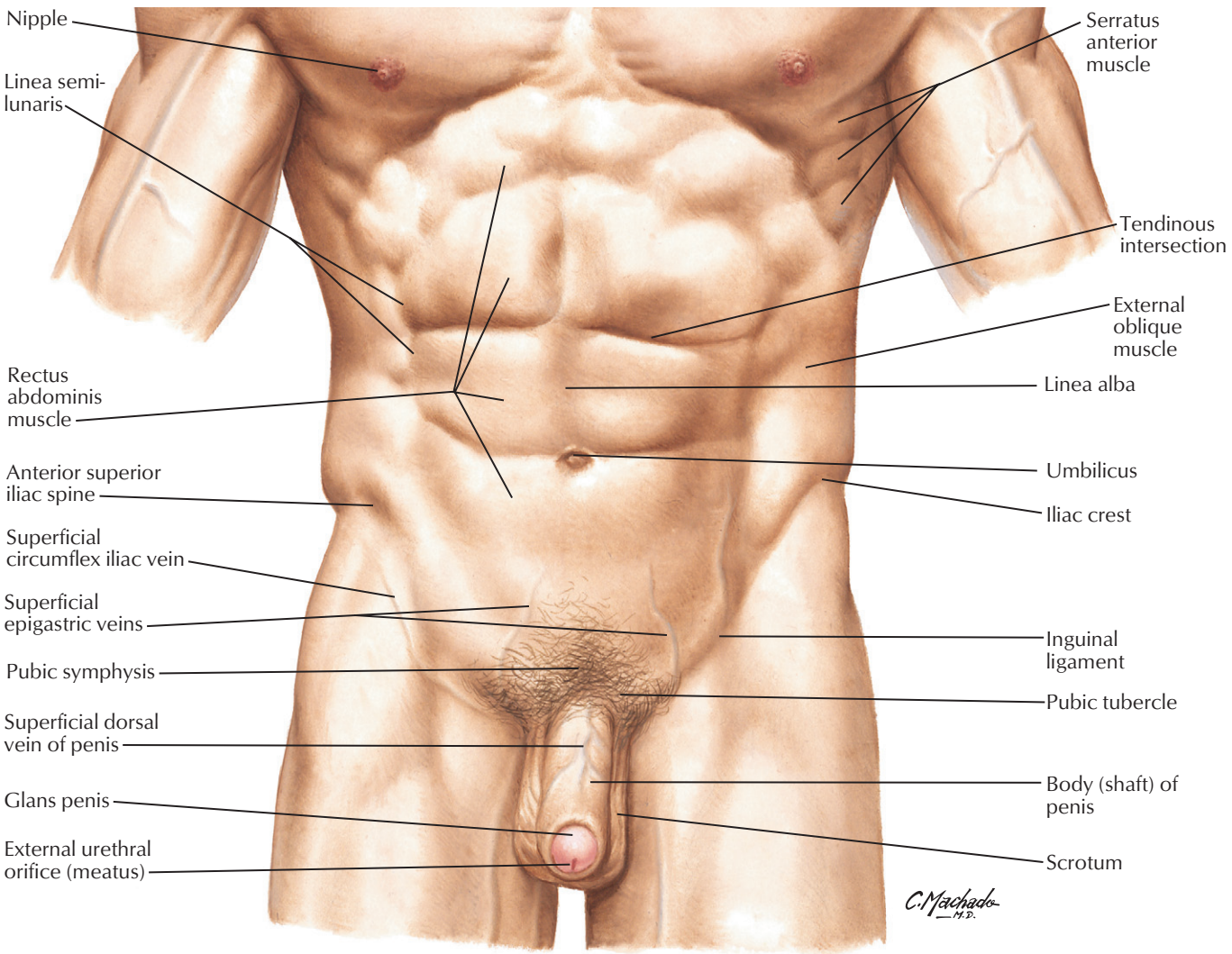
Plates 396–397

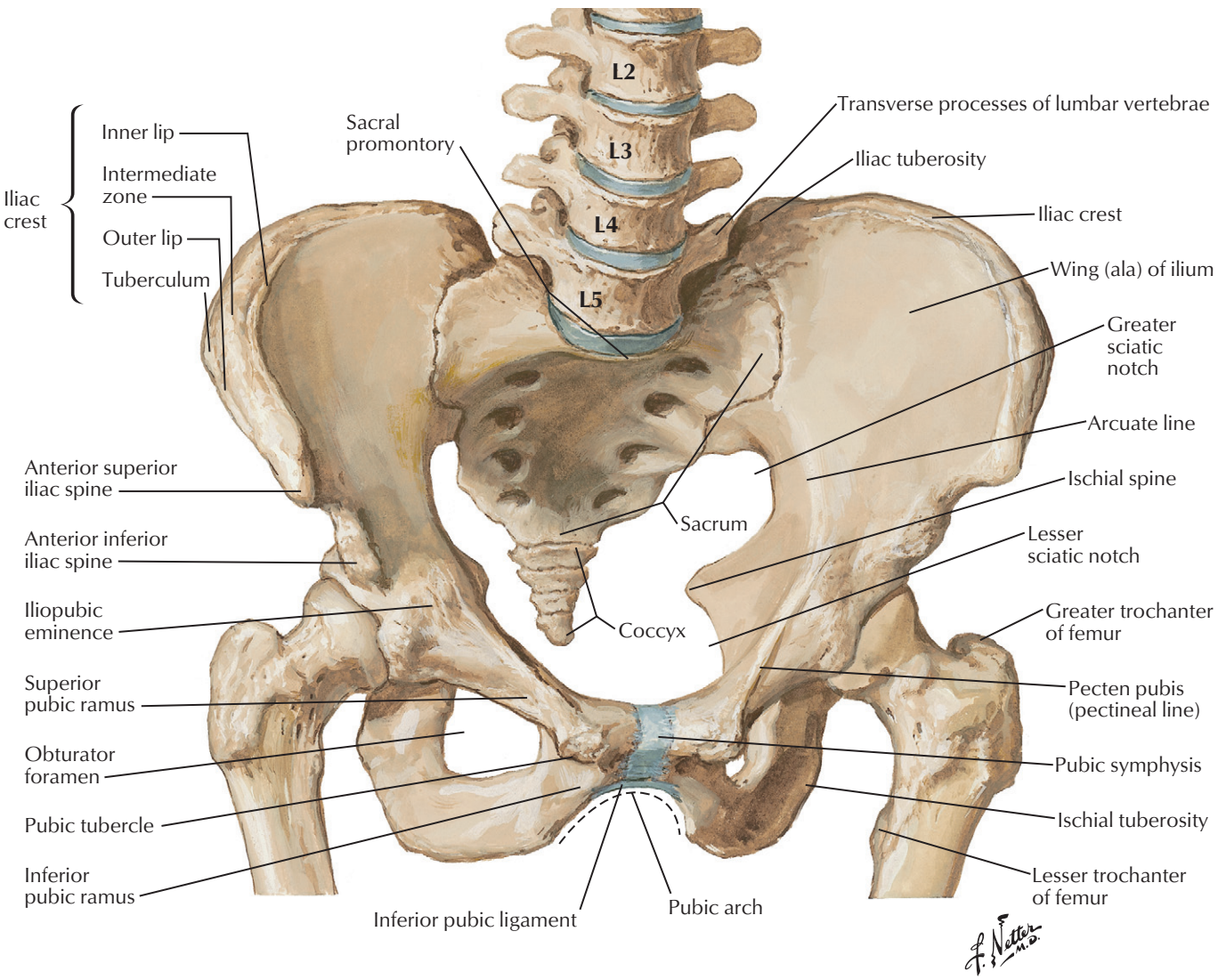
396 Male Pelvis: Cross Section of Bladder-Prostate Junction

397 Female Pelvis: Cross Section of Vagina-Urethra

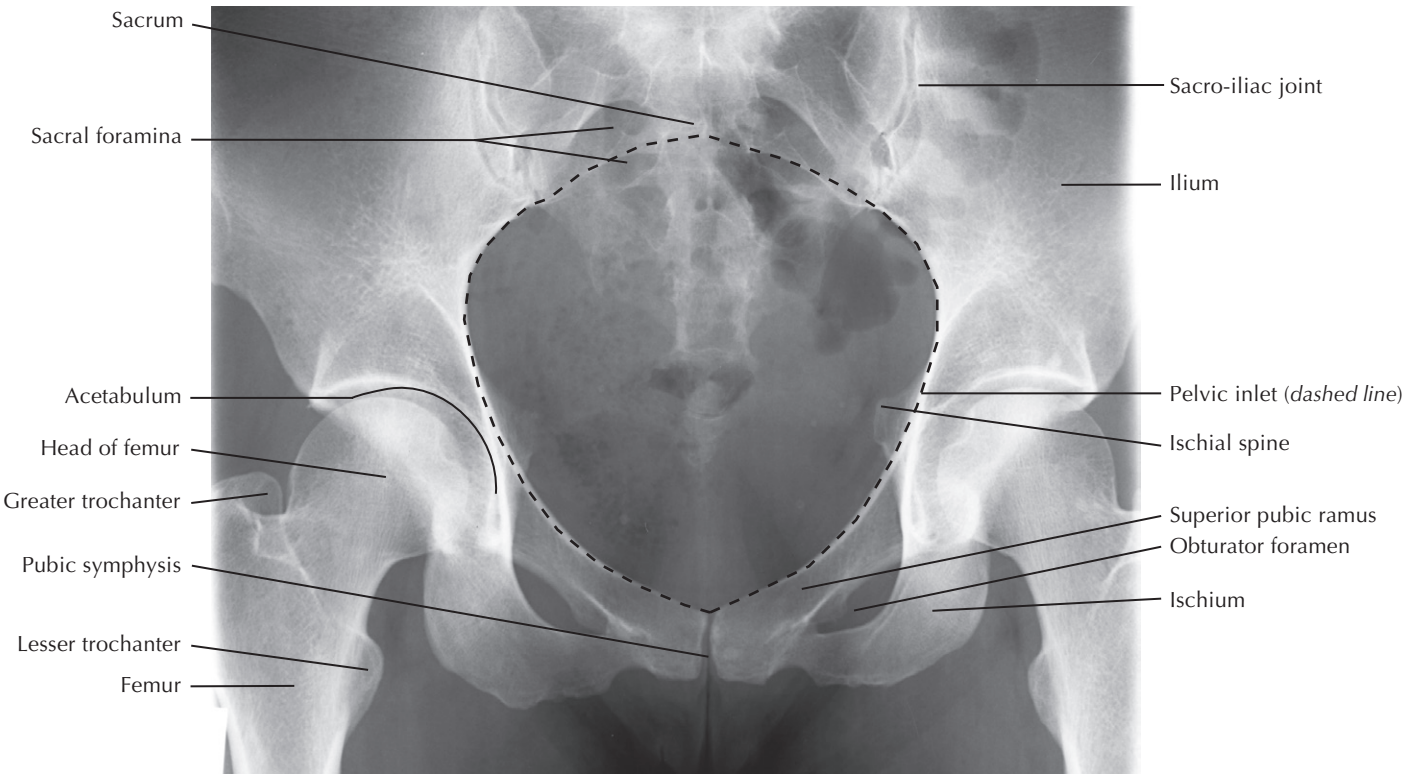
Muscle Tables

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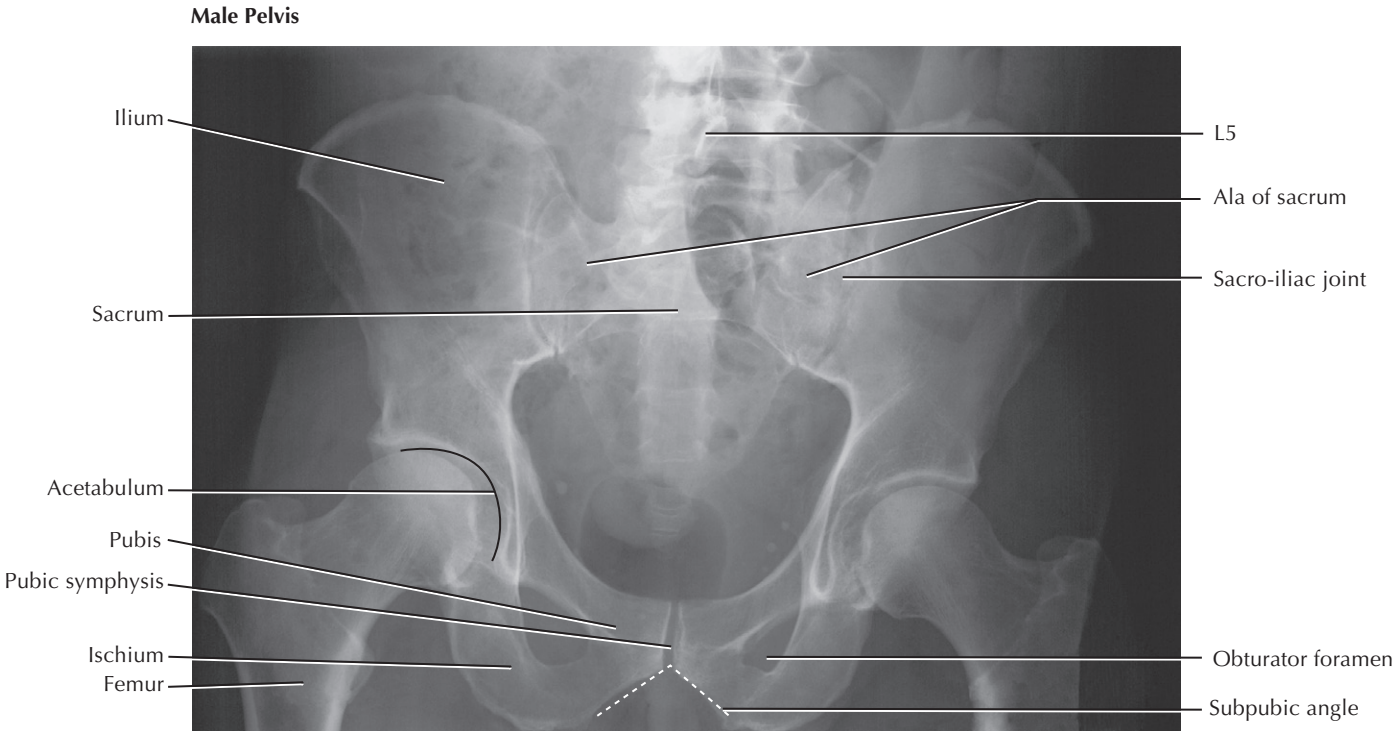

Nipple
Linea semi-lunaris
Rectus abdominis muscle
Anterior superior iliac spine
Superficial circumflex iliac vein
Superficial epigastric veins
Pubic symphysis
Superficial dorsal vein of penis
Glans penis
External urethral orifice (meatus)
Serratus anterior muscle
Tendinous intersection
External oblique muscle
Linea alba
Umbilicus
Iliac crest
Inguinal ligament
Pubic tubercle
Body (shaft) of penis
Scrotum
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L2
L3
L4
L5
Transverse processes of lumbar vertebrae
Sacral promontory
Iliac tuberosity
Iliac crest
Inner lip
Intermediate zone
Outer lip
Tuberculum
Iliac crest
Wing (ala) of ilium
Greater sciatic notch
Arcuate line
Anterior superior iliac spine
Ischial spine
Sacrum
Anterior inferior iliac spine
Lesser sciatic notch
Iliopubic eminence
Coccyx
Greater trochanter of femur
Superior pubic ramus
Pecten pubis (pectineal line)
Obturator foramen
Pubic symphysis
Pubic tubercle
Ischial tuberosity
Inferior pubic ramus
Lesser trochanter of femur
Inferior pubic ligament
Pubic arch

Female Pelvis



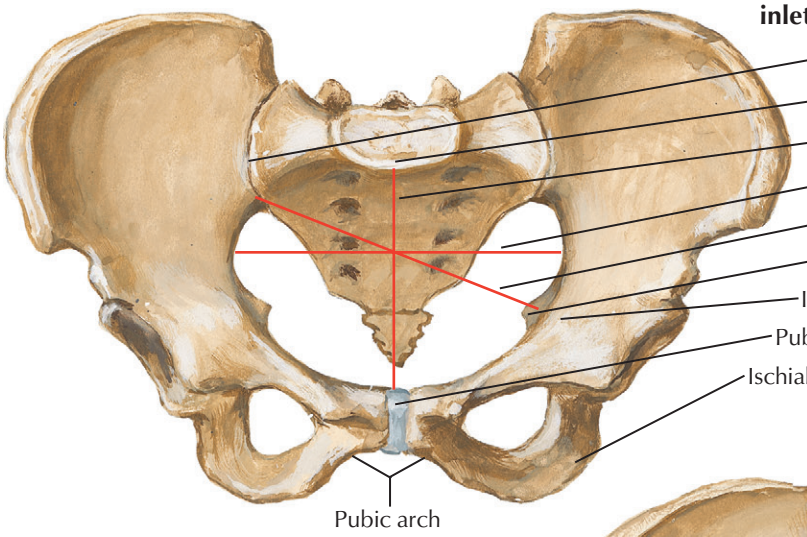
Male Pelvis



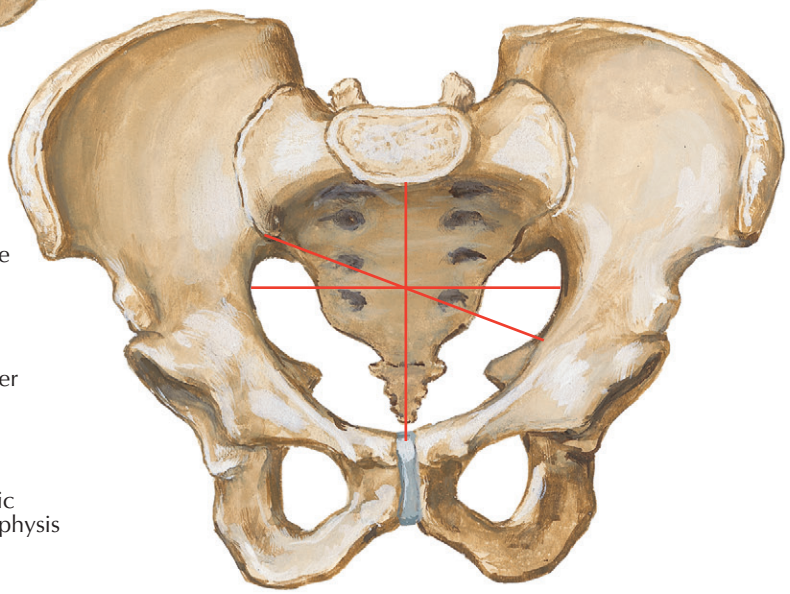
Sex Differences of Pelvis: Measurements

See also **Plate 243**

Female pelvis/female pelvic inlet: anterior view

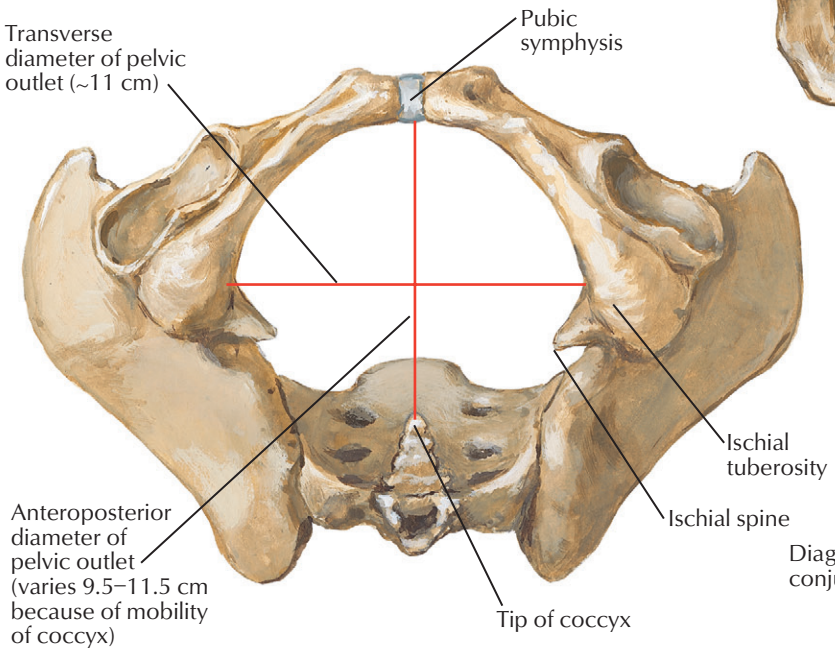


Male pelvis/male pelvic inlet: anterior view

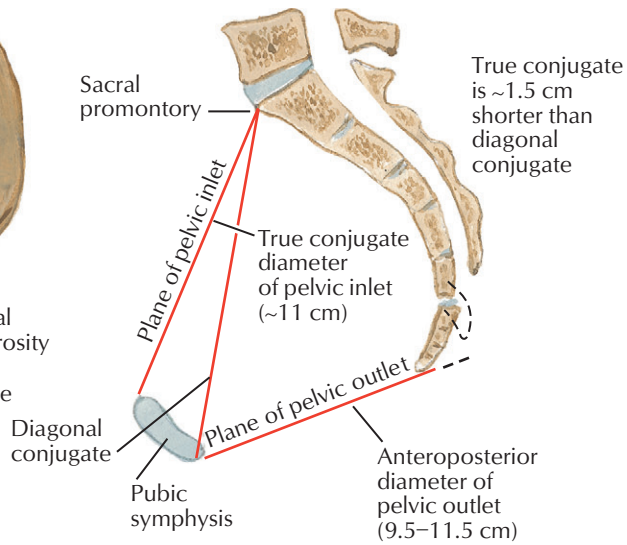


Diagonal conjugate is only diameter of pelvic inlet that can be measured clinically

- All measurements slightly shorter in relation to body size than in female
- Pelvic inlet oriented more antero-posteriorly than in female, where it tends to be transversely oval
- Pubic symphysis deeper (taller)
- Pubic arch (subpubic angle) narrower
- Ischial tuberosities less far apart
- Iliac wings less flared

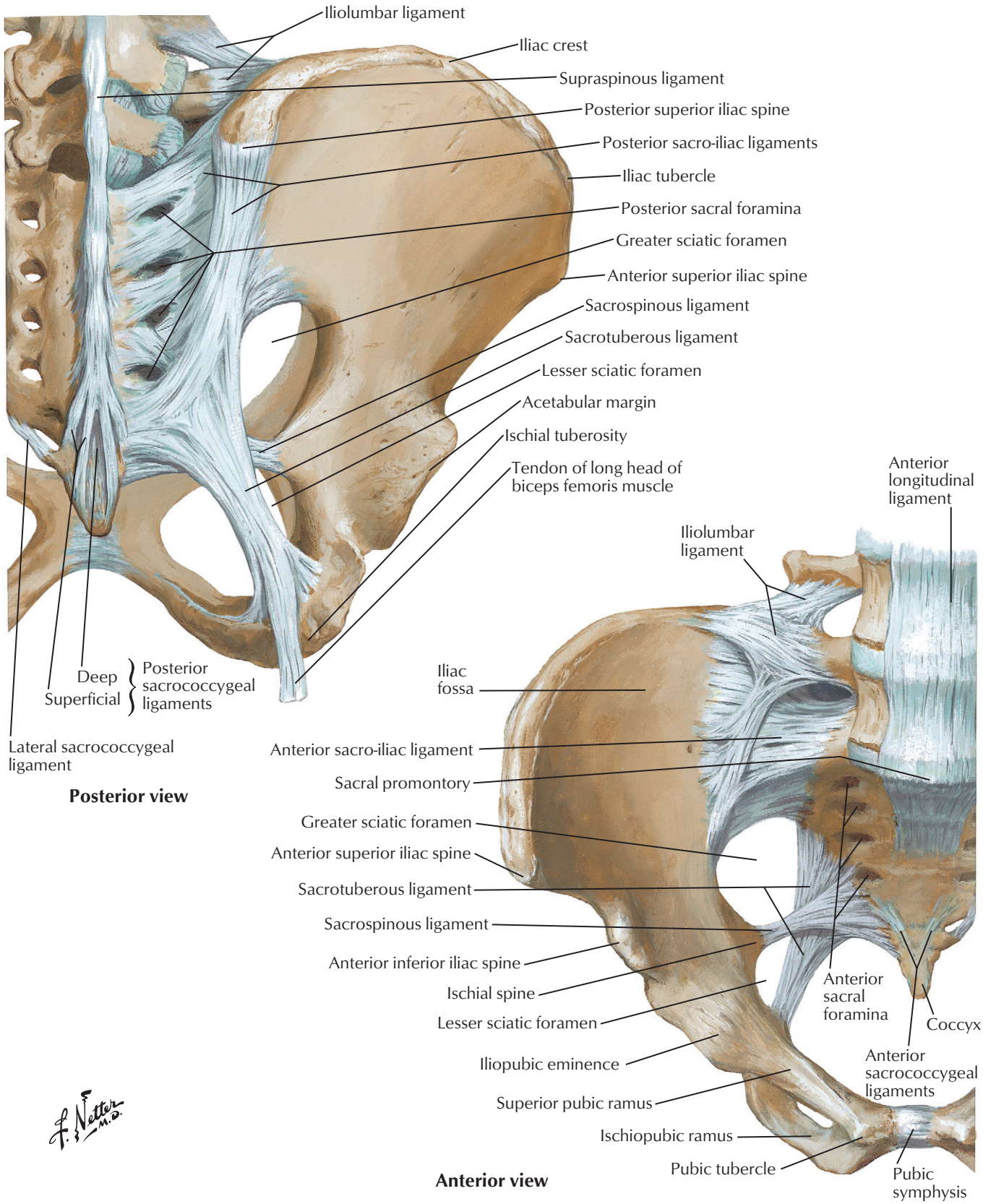


Female pelvis/female pelvic outlet: inferior view

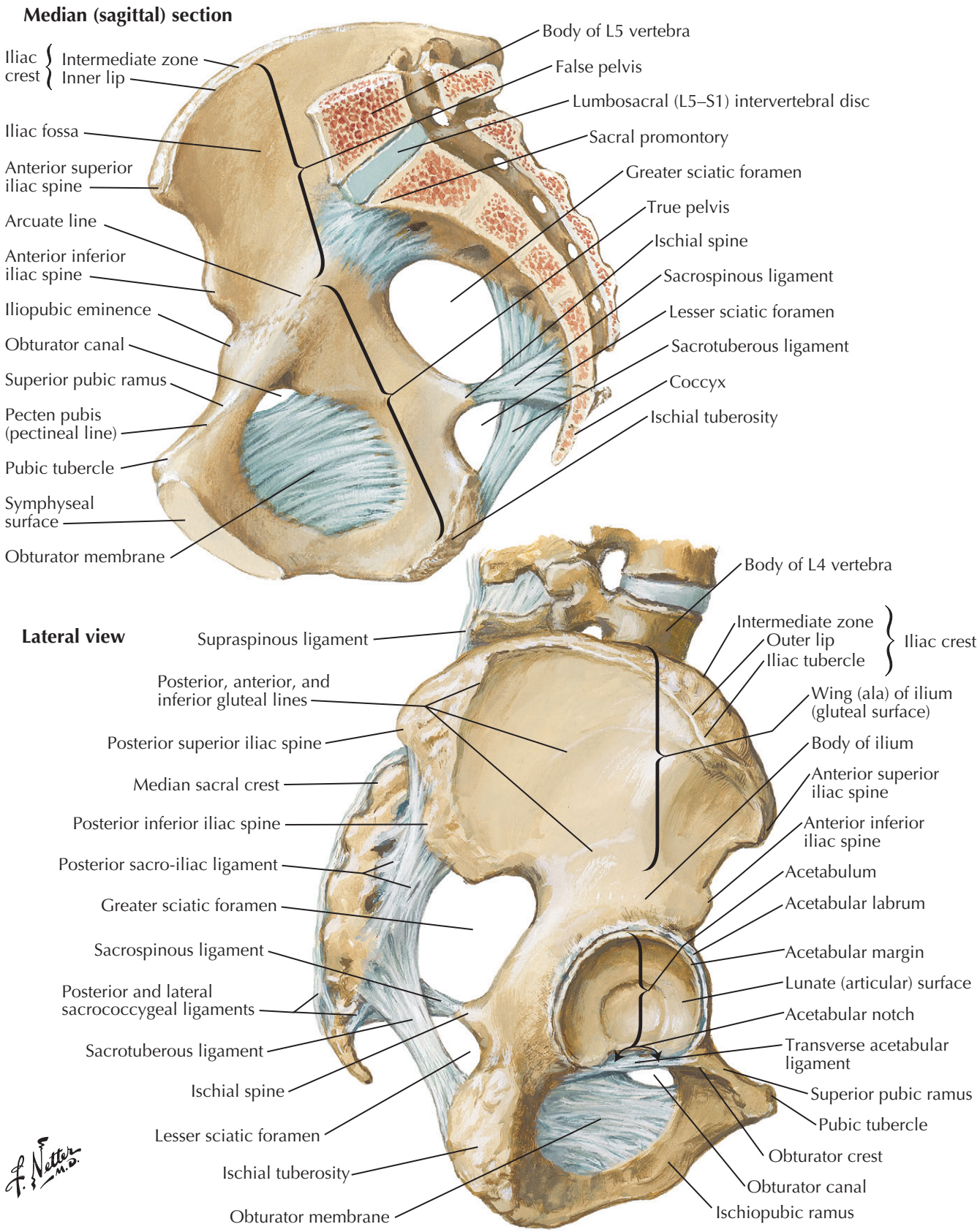


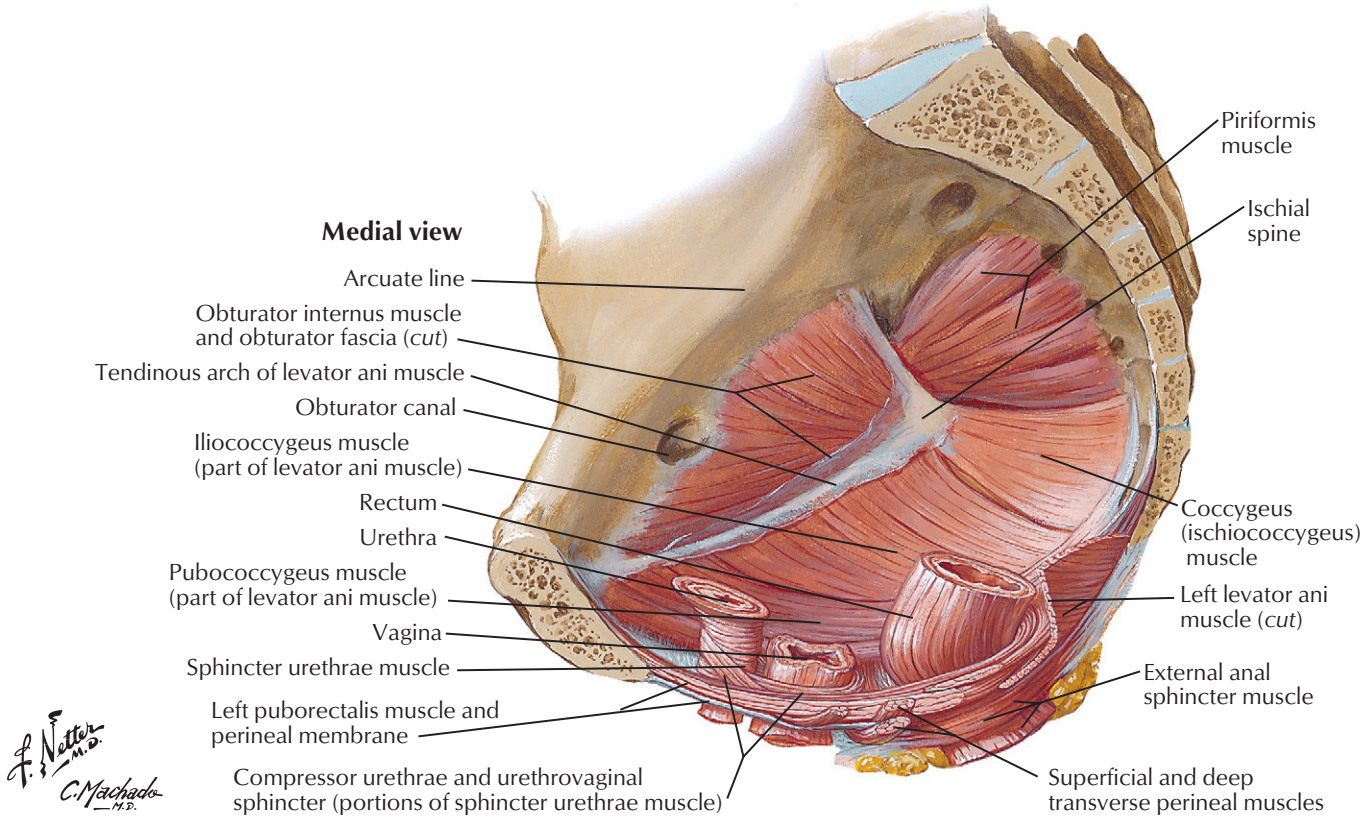
Transverse diameter is the widest distance of pelvic inlet

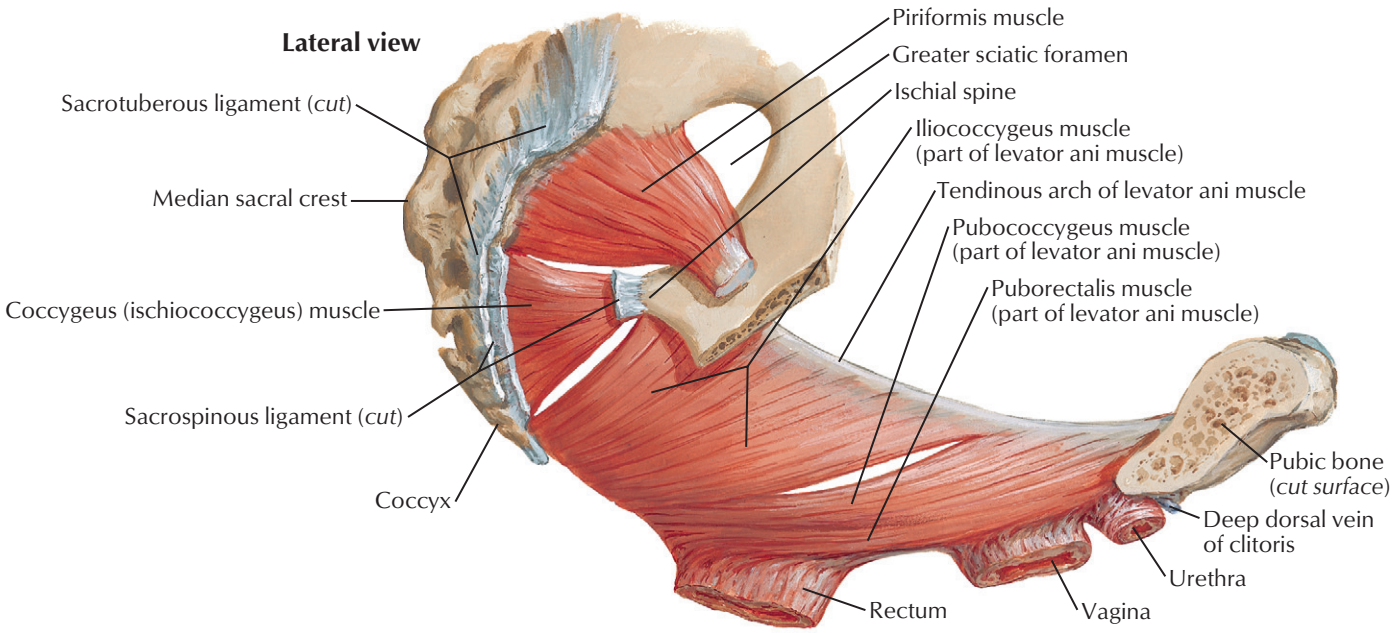
Female: sagittal section


Iliolumbar ligament
Iliac crest
Supraspinous ligament
Posterior superior iliac spine
Posterior sacro-iliac ligaments
Iliac tubercle
Posterior sacral foramina
Greater sciatic foramen
Anterior superior iliac spine
Sacrospinous ligament
Sacrotuberous ligament
Lesser sciatic foramen
Acetabular margin
Ischial tuberosity
Tendon of long head of biceps femoris muscle
Deep
Superficial
Posterior sacrococcygeal ligaments
Lateral sacrococcygeal ligament
Posterior view
Anterior longitudinal ligament
Iliolumbar ligament
Iliac fossa
Anterior sacro-iliac ligament
Sacral promontory
Greater sciatic foramen
Anterior superior iliac spine
Sacrotuberous ligament
Sacrospinous ligament
Anterior inferior iliac spine
Ischial spine
Lesser sciatic foramen
Iliopubic eminence
Superior pubic ramus
Ischiopubic ramus
Pubic tubercle
Anterior sacral foramina
Coccyx
Anterior sacrococcygeal ligaments
Pubic symphysis
Anterior view

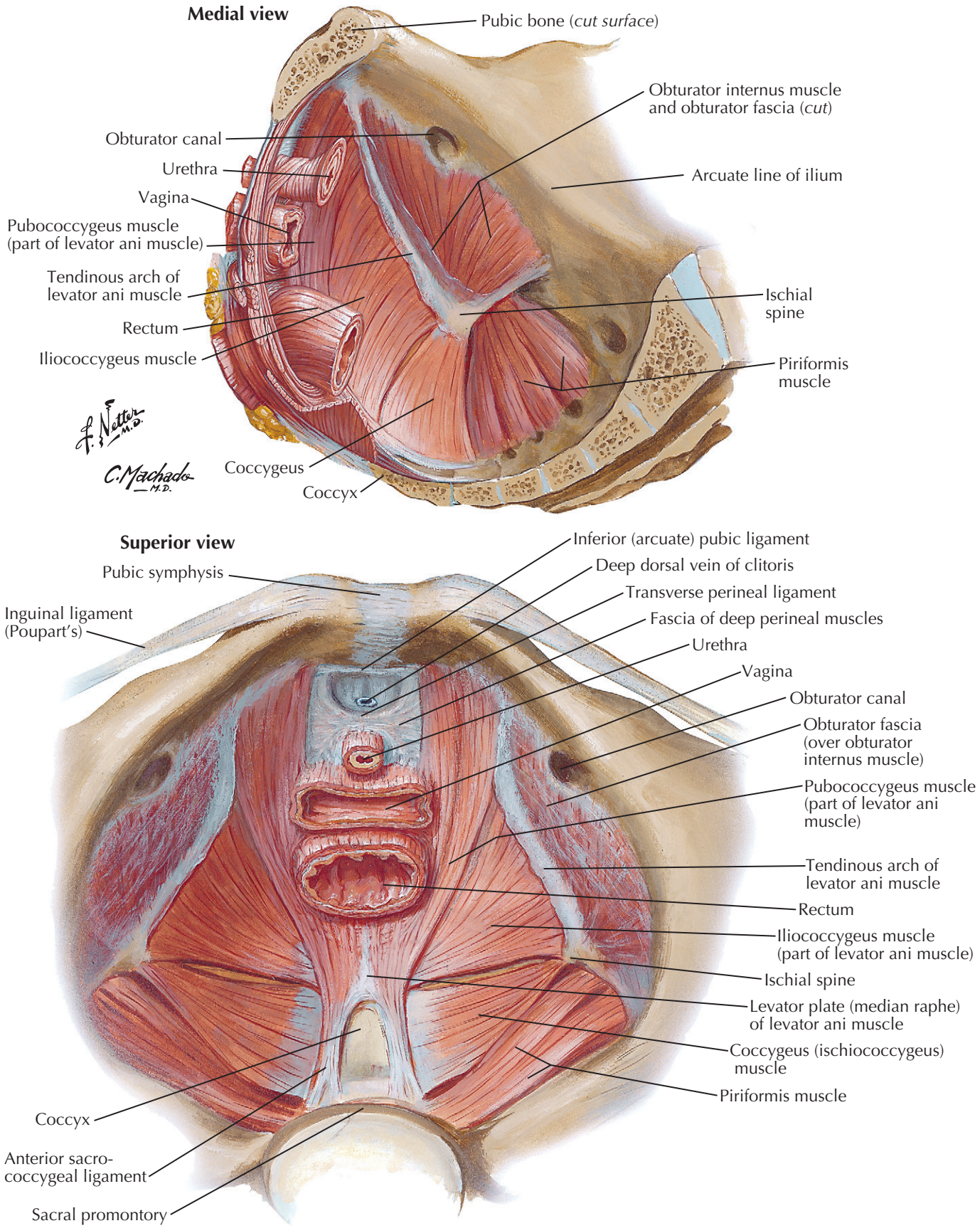
See also Plate 158

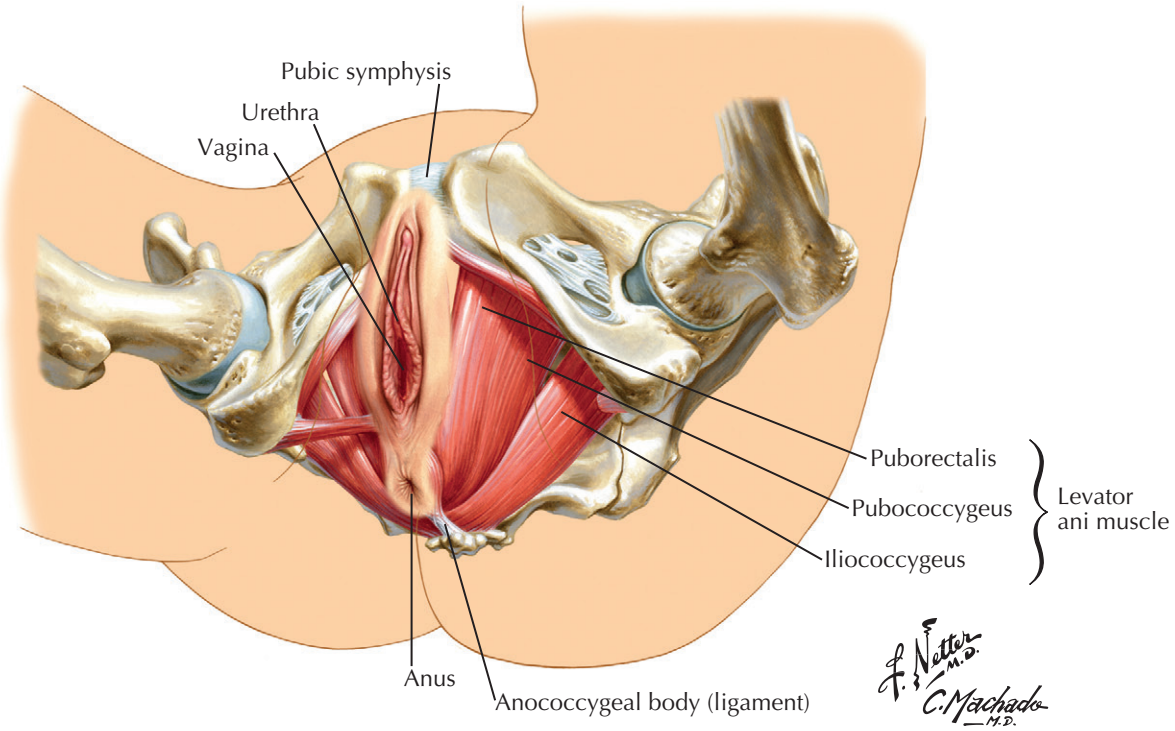



Medial view
Arcuate line
Obturator internus muscle and obturator fascia (cut)
Tendinous arch of levator ani muscle
Obturator canal
Iliococcygeus muscle (part of levator ani muscle)
Rectum
Urethra
Pubococcygeus muscle (part of levator ani muscle)
Vagina
Sphincter urethrae muscle
Left puborectalis muscle and perineal membrane
Compressor urethrae and urethrovaginal sphincter (portions of sphincter urethrae muscle)
Piriformis muscle
Ischial spine
Coccygeus (ischiococcygeus) muscle
Left levator ani muscle (cut)
External anal sphincter muscle
Superficial and deep transverse perineal muscles
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C. Machado M.D.

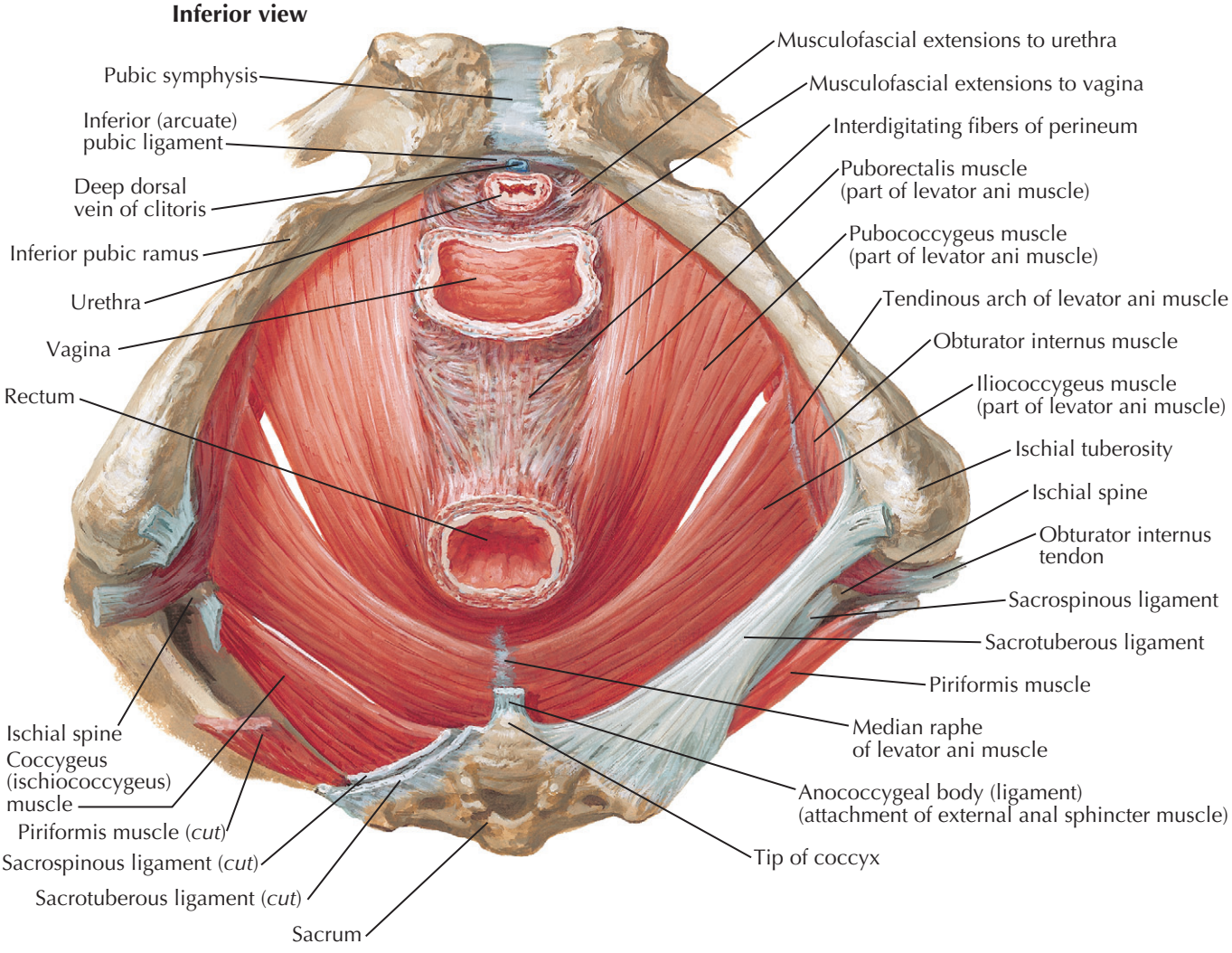

Lateral view
Sacrotuberous ligament (cut)
Median sacral crest
Coccygeus (ischiococcygeus) muscle
Sacrospinous ligament (cut)
Coccyx
Piriformis muscle
Greater sciatic foramen
Ischial spine
Iliococcygeus muscle (part of levator ani muscle)
Tendinous arch of levator ani muscle
Pubococcygeus muscle (part of levator ani muscle)
Puborectalis muscle (part of levator ani muscle)
Pubic bone (cut surface)
Deep dorsal vein of clitoris
Urethra
Vagina
Rectum

For urogenital diaphragm see **Plate 356**



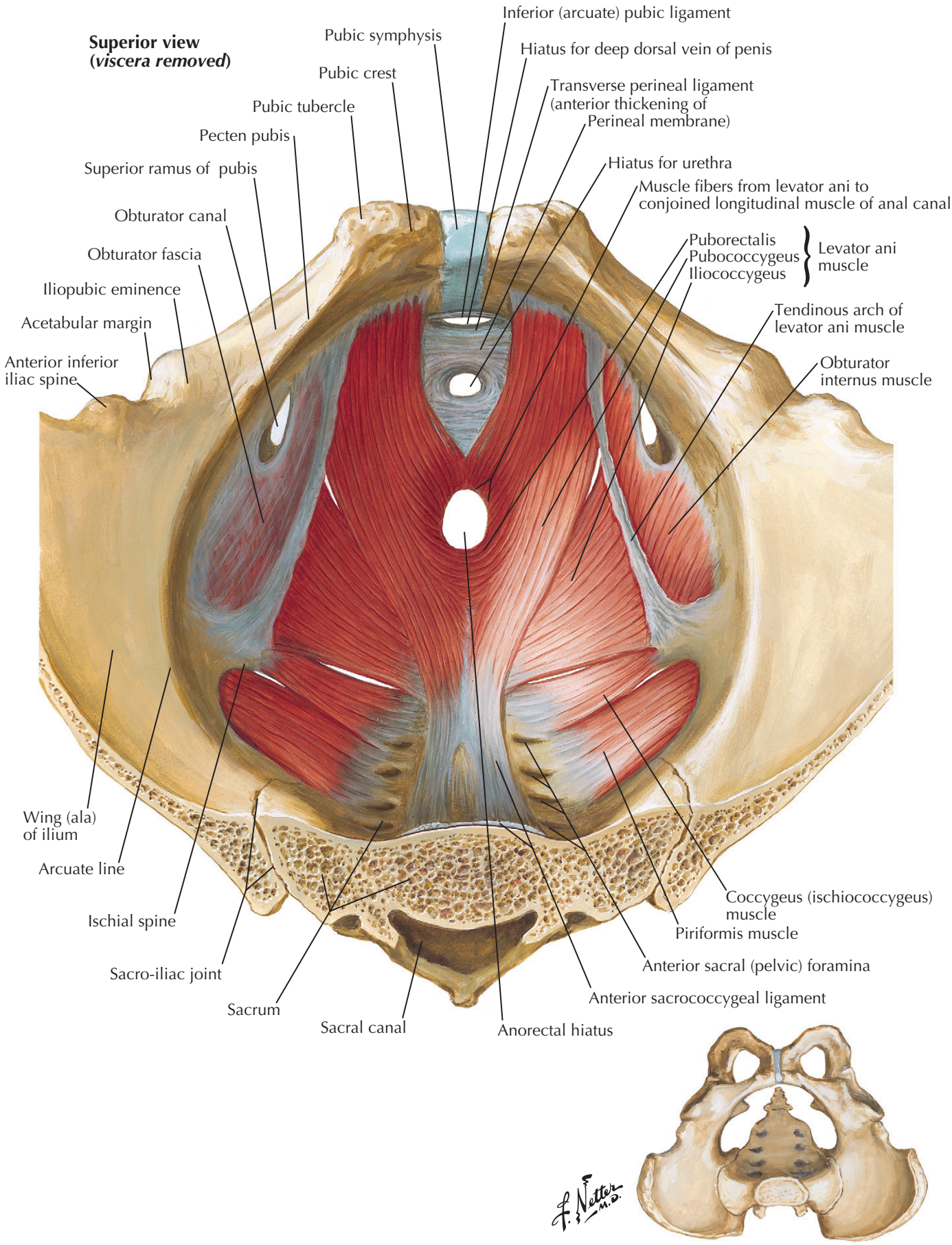


Inferior view



Pelvic Diaphragm: Male

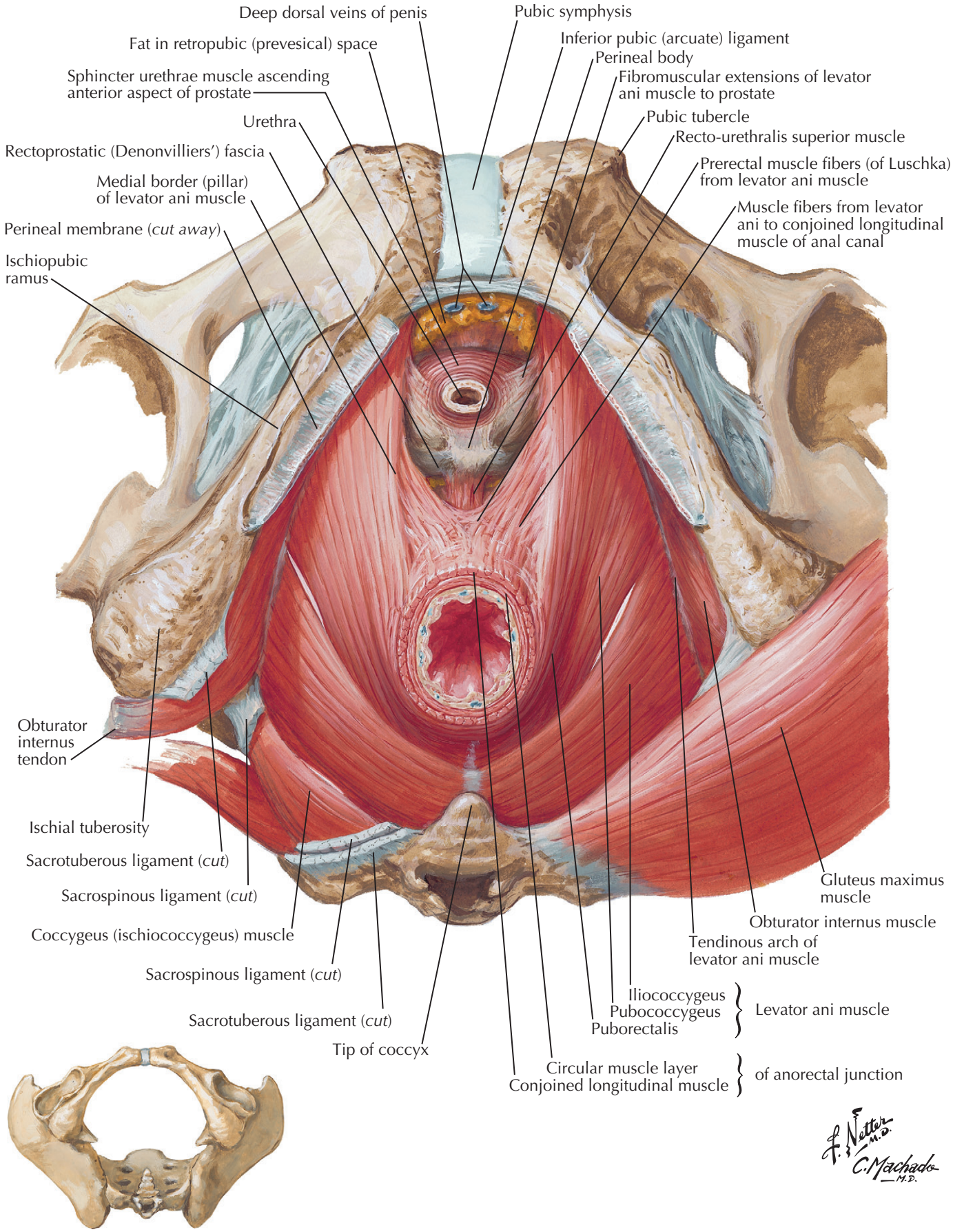
See also Plates 258, 261



Pelvic Diaphragm: Male (continued)

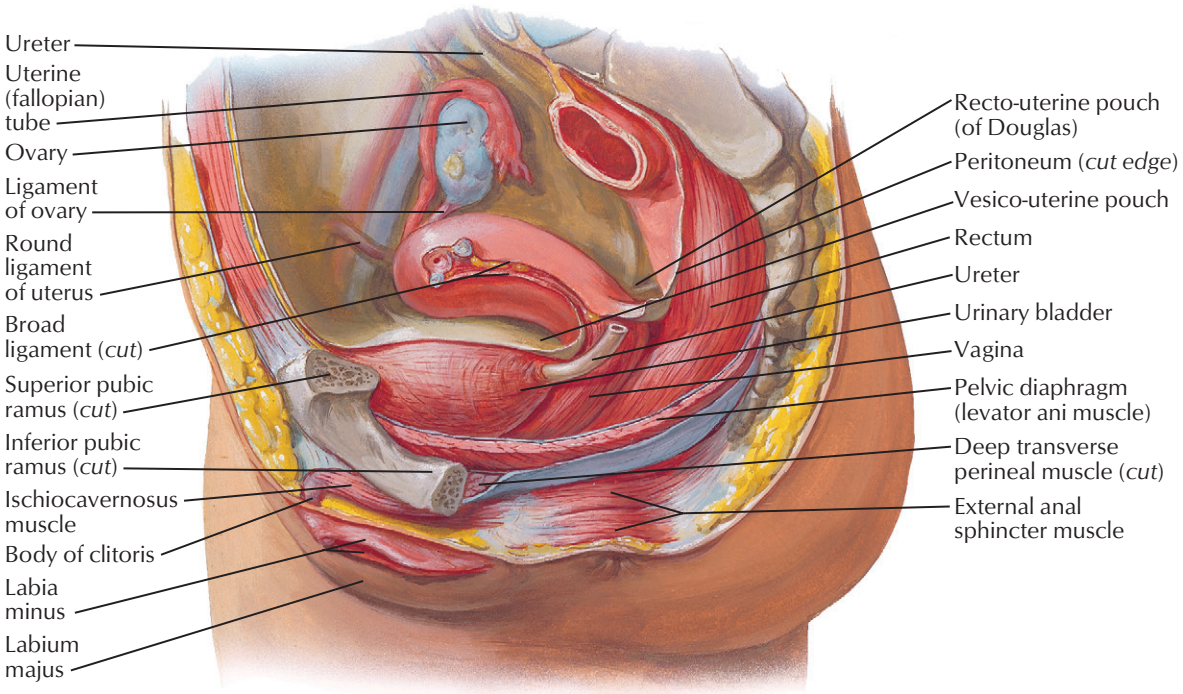
For urogenital diaphragm see **Plate 361**

Inferior view

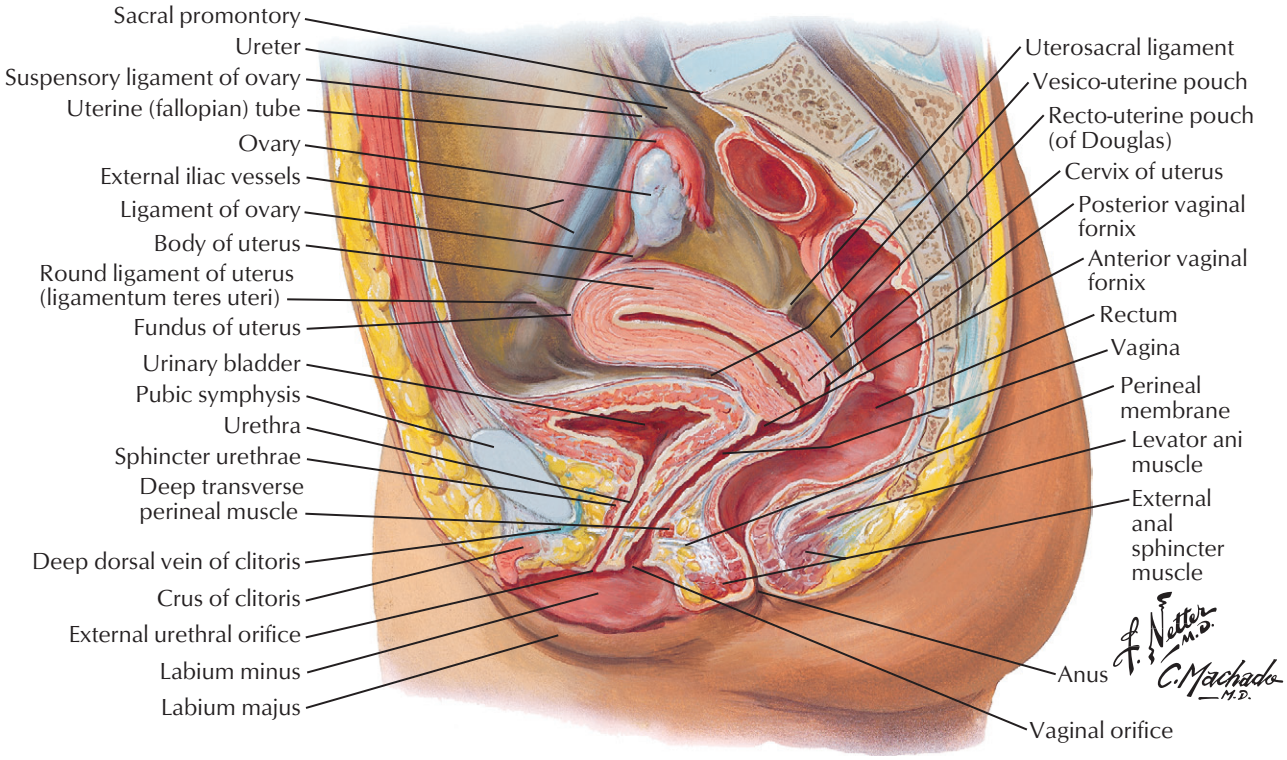


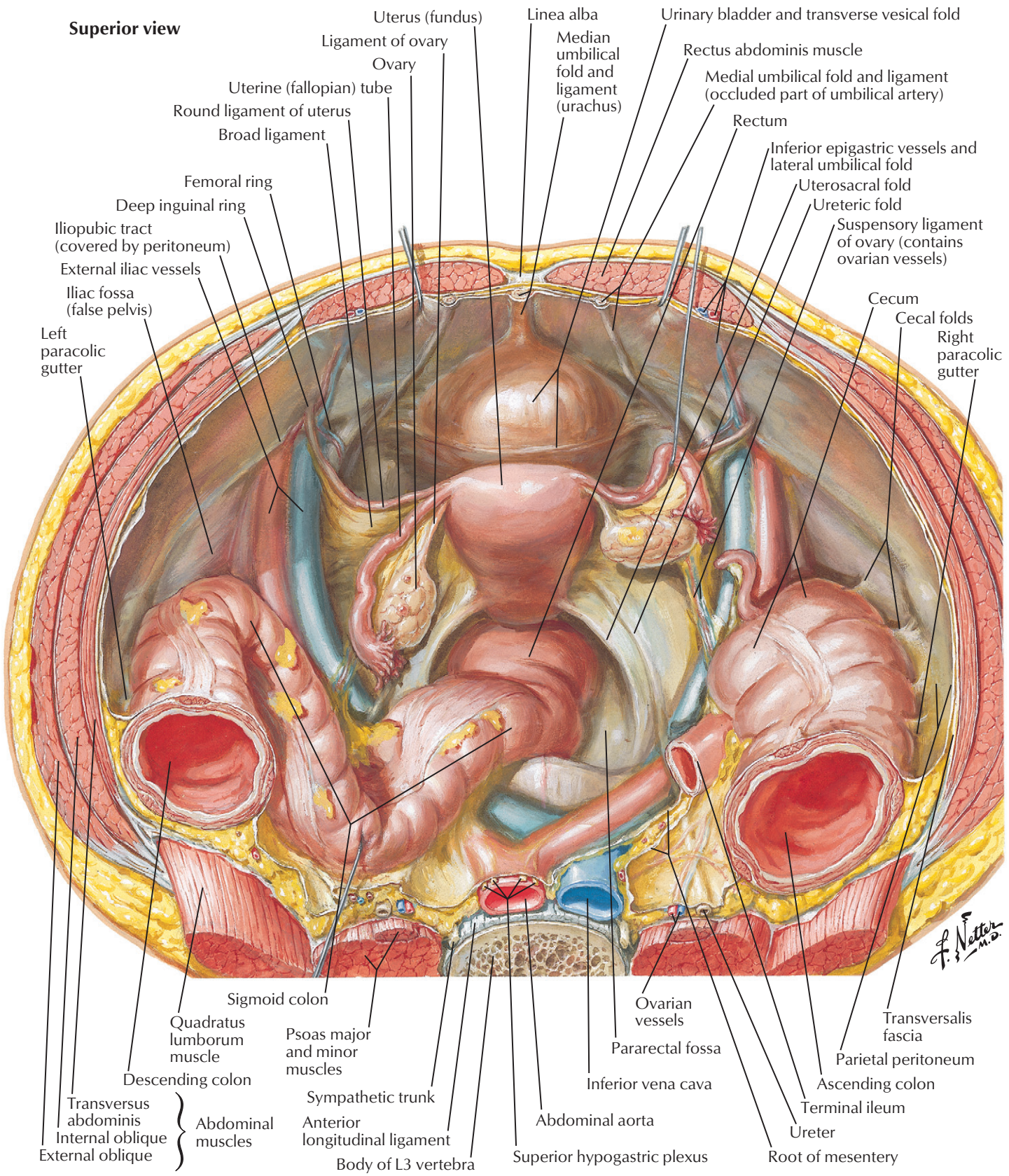
F. Netter M.D.
C. Machado M.D.

Paramedian (sagittal) dissection

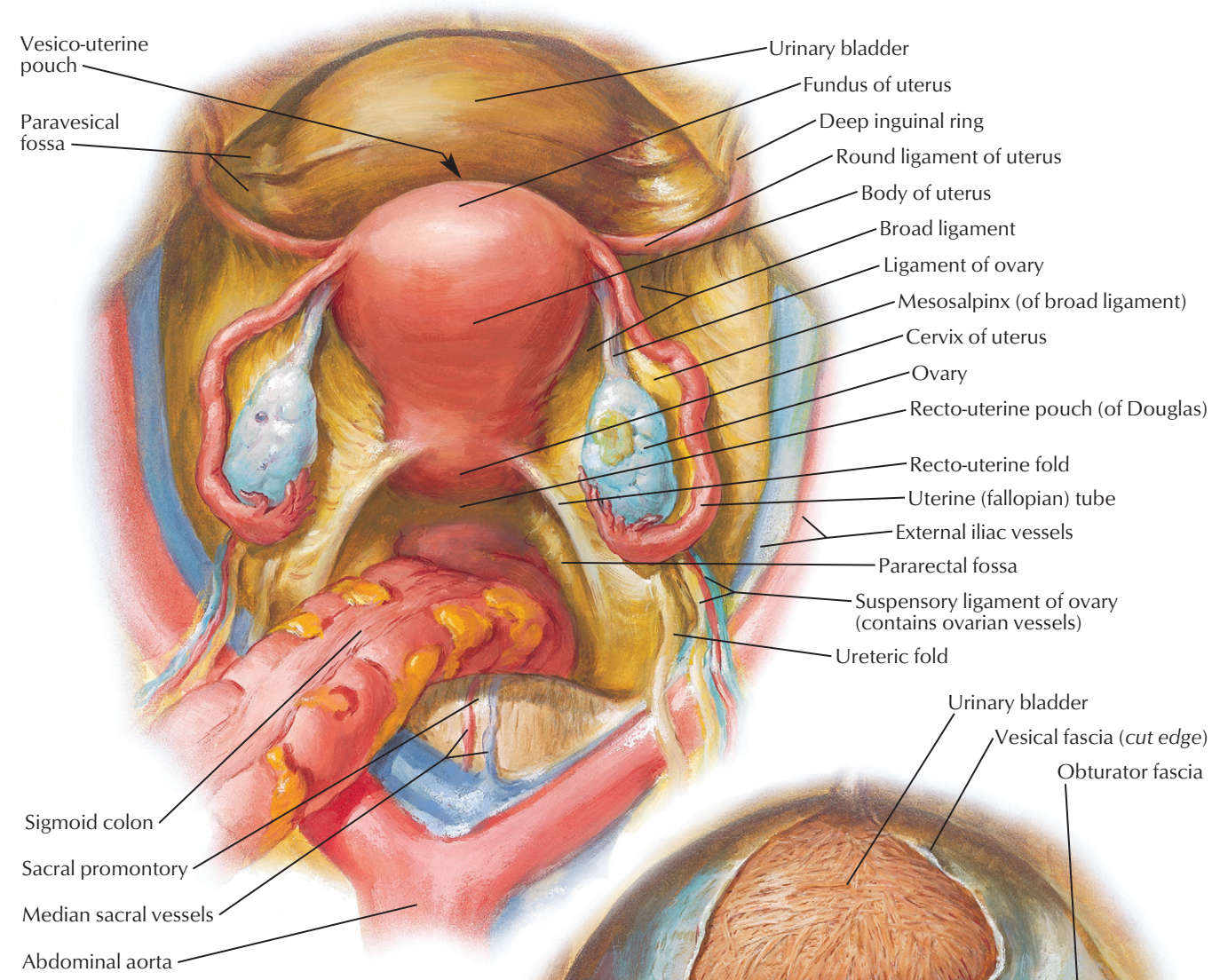


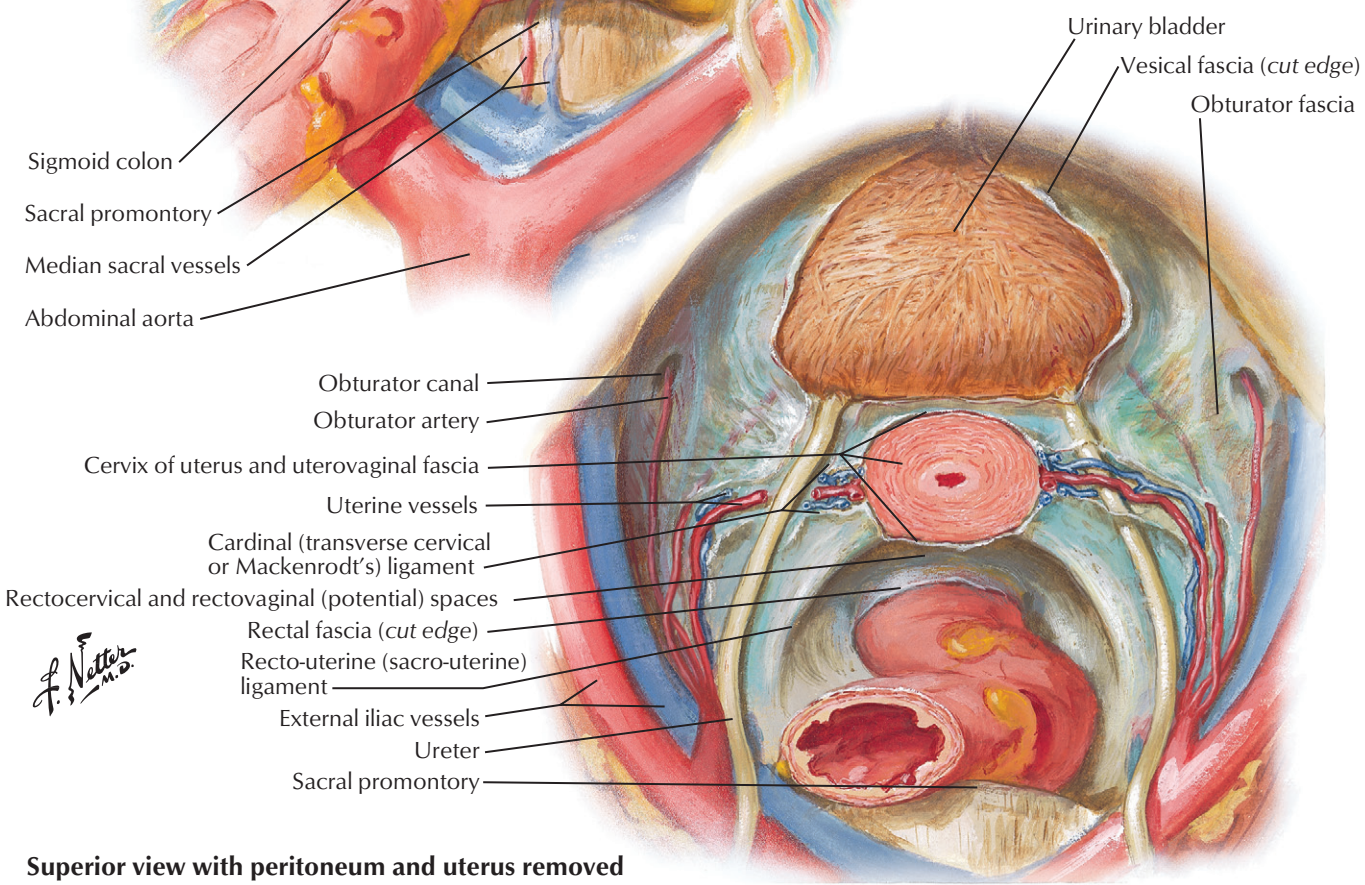
Median (sagittal) section




Superior view
Uterus (fundus)
Ligament of ovary
Ovary
Uterine (fallopian) tube
Round ligament of uterus
Broad ligament
Femoral ring
Deep inguinal ring
Iliopubic tract (covered by peritoneum)
External iliac vessels
Iliac fossa (false pelvis)
Left paracolic gutter
Linea alba
Median umbilical fold and ligament (urachus)
Urinary bladder and transverse vesical fold
Rectus abdominis muscle
Medial umbilical fold and ligament (occluded part of umbilical artery)
Rectum
Inferior epigastric vessels and lateral umbilical fold
Uterosacral fold
Ureteric fold
Suspensory ligament of ovary (contains ovarian vessels)
Cecum
Cecal folds
Right paracolic gutter
Sigmoid colon
Quadratus lumborum muscle
Psoas major and minor muscles
Descending colon
Transversus abdominis
Internal oblique
External oblique
Abdominal muscles
Sympathetic trunk
Anterior longitudinal ligament
Body of L3 vertebra
Abdominal aorta
Superior hypogastric plexus
Ovarian vessels
Pararectal fossa
Inferior vena cava
Ureter
Root of mesentery
Terminal ileum
Ascending colon
Parietal peritoneum
Transversalis fascia
F. Netter M.D.

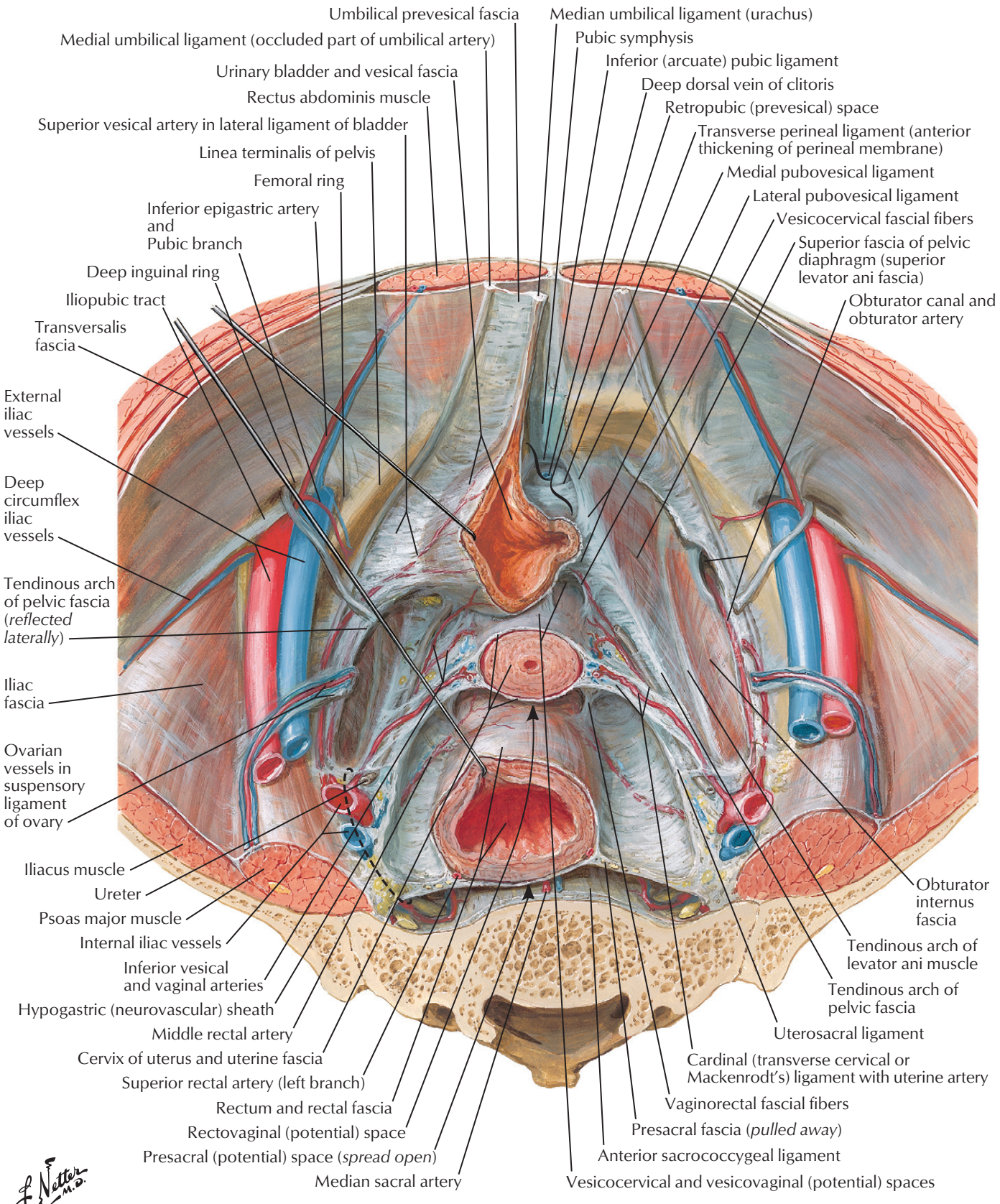
Superior view with peritoneum intact

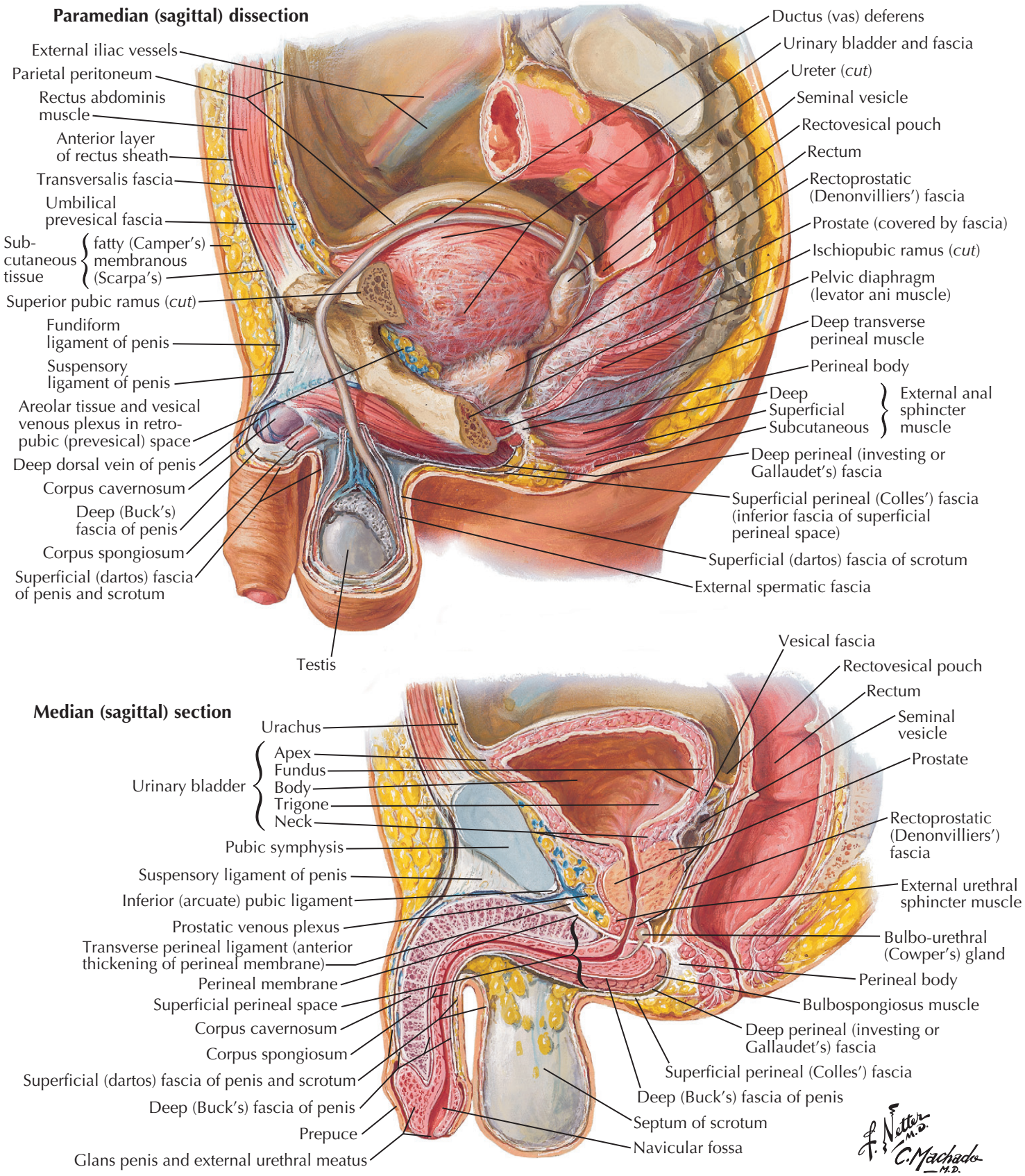




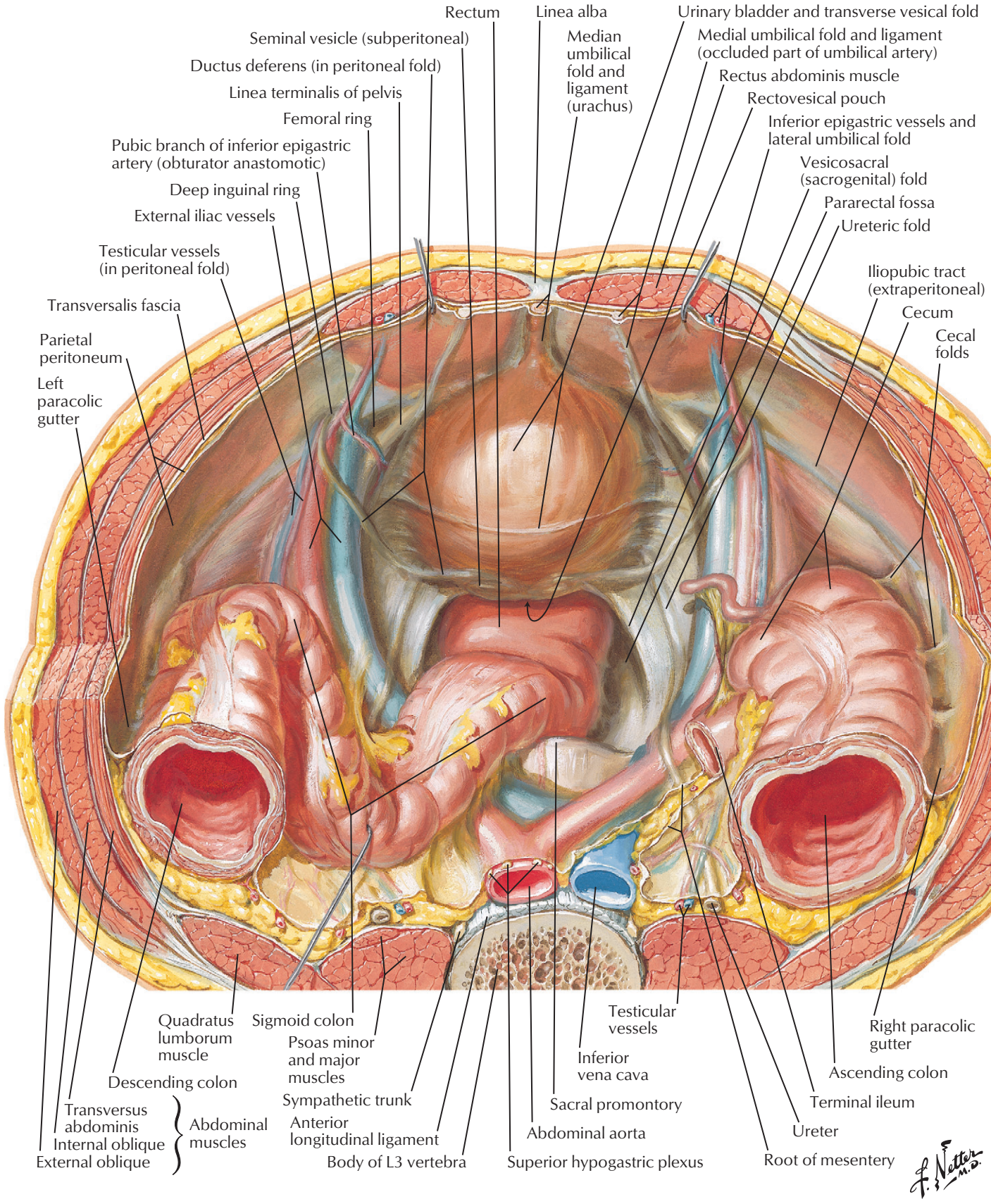
Superior view with peritoneum and uterus removed

Female: superior view (peritoneum and loose areolar tissue removed)

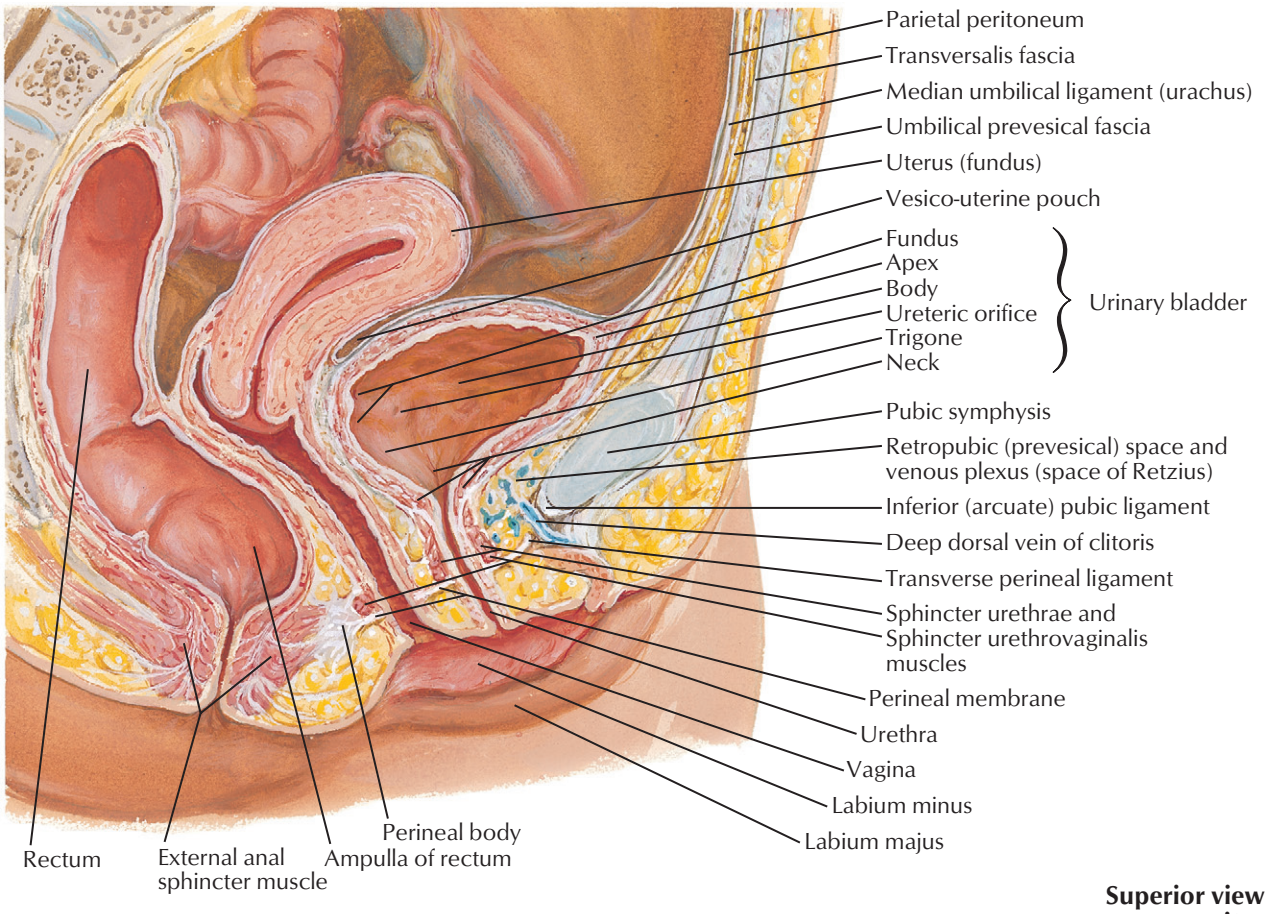



Paramedian (sagittal) dissection
External iliac vessels
Parietal peritoneum
Rectus abdominis muscle
Anterior layer of rectus sheath
Transversalis fascia
Umbilical prevesical fascia
Sub-cutaneous tissue
fatty (Camper's)
membranous (Scarpa's)
Superior pubic ramus (cut)
Fundiform ligament of penis
Suspensory ligament of penis
Areolar tissue and vesical venous plexus in retro-pubic (prevesical) space
Deep dorsal vein of penis
Corpus cavernosum
Deep (Buck's) fascia of penis
Corpus spongiosum
Superficial (dartos) fascia of penis and scrotum
Testis
Ductus (vas) deferens
Urinary bladder and fascia
Ureter (cut)
Seminal vesicle
Rectovesical pouch
Rectum
Rectoprostatic (Denonvilliers') fascia
Prostate (covered by fascia)
Ischiopubic ramus (cut)
Pelvic diaphragm (levator ani muscle)
Deep transverse perineal muscle
Perineal body
Deep
Superficial
Subcutaneous
External anal sphincter muscle
Deep perineal (investing or Gallaudet's) fascia
Superficial perineal (Colles') fascia (inferior fascia of superficial perineal space)
Superficial (dartos) fascia of scrotum
External spermatic fascia
Median (sagittal) section
Urachus
Urinary bladder
Apex
Fundus
Body
Trigone
Neck
Pubic symphysis
Suspensory ligament of penis
Inferior (arcuate) pubic ligament
Prostatic venous plexus
Transverse perineal ligament (anterior thickening of perineal membrane)
Perineal membrane
Superficial perineal space
Corpus cavernosum
Corpus spongiosum
Superficial (dartos) fascia of penis and scrotum
Deep (Buck's) fascia of penis
Prepuce
Glans penis and external urethral meatus
Vesical fascia
Rectovesical pouch
Rectum
Seminal vesicle
Prostate
Rectoprostatic (Denonvilliers') fascia
External urethral sphincter muscle
Bulbo-urethral (Cowper's) gland
Perineal body
Bulbospongiosus muscle
Deep perineal (investing or Gallaudet's) fascia
Superficial perineal (Colles') fascia
Deep (Buck's) fascia of penis
Septum of scrotum
Navicular fossa

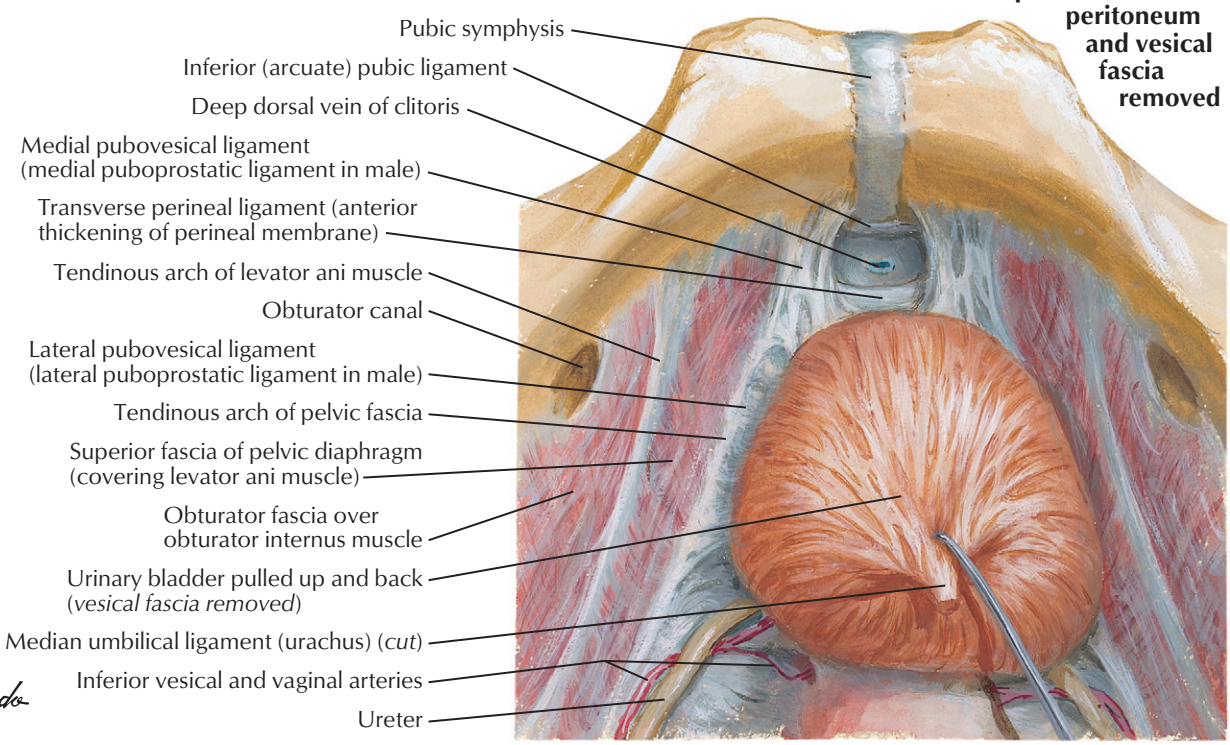
Superior view

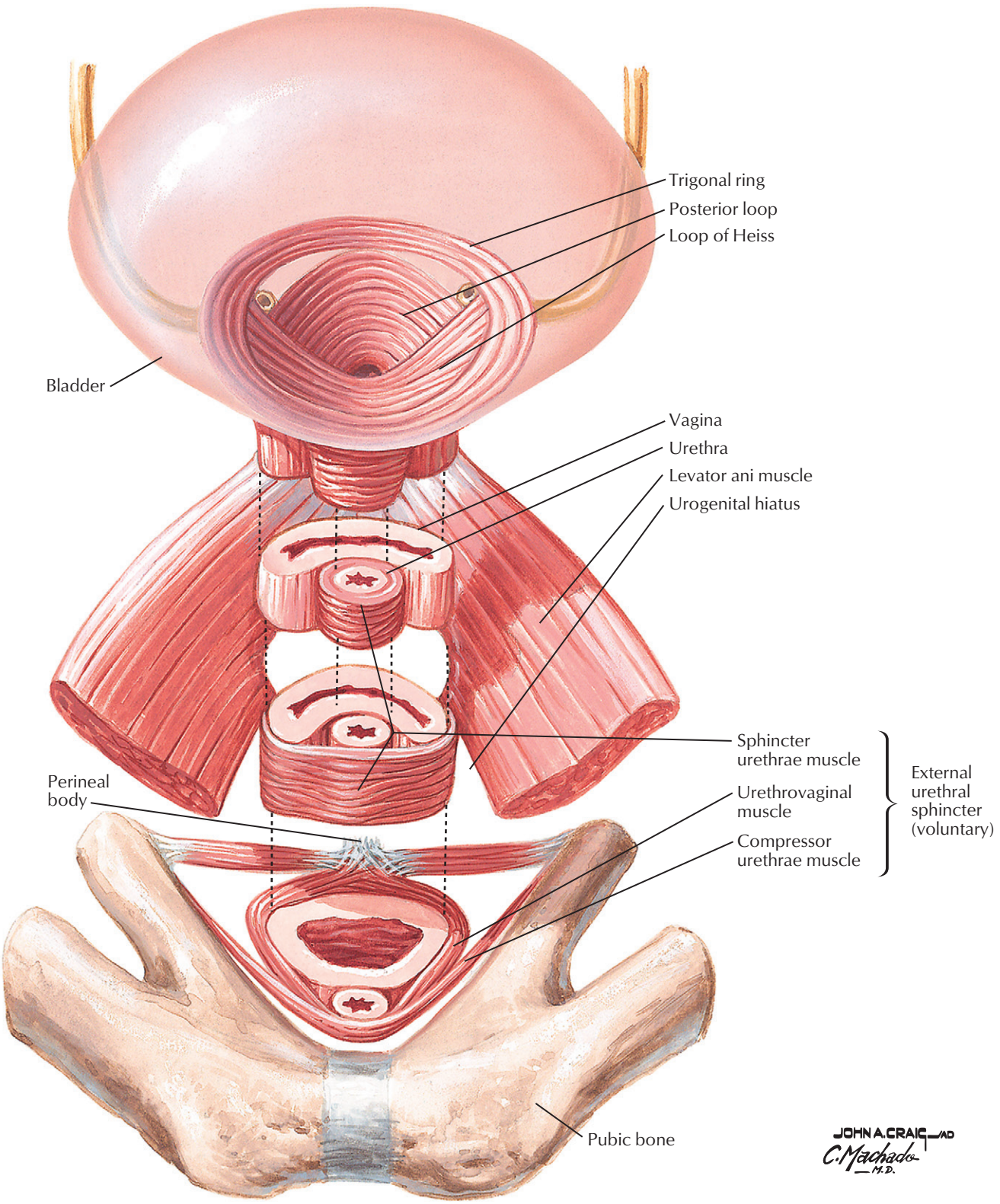


Female: midsagittal section



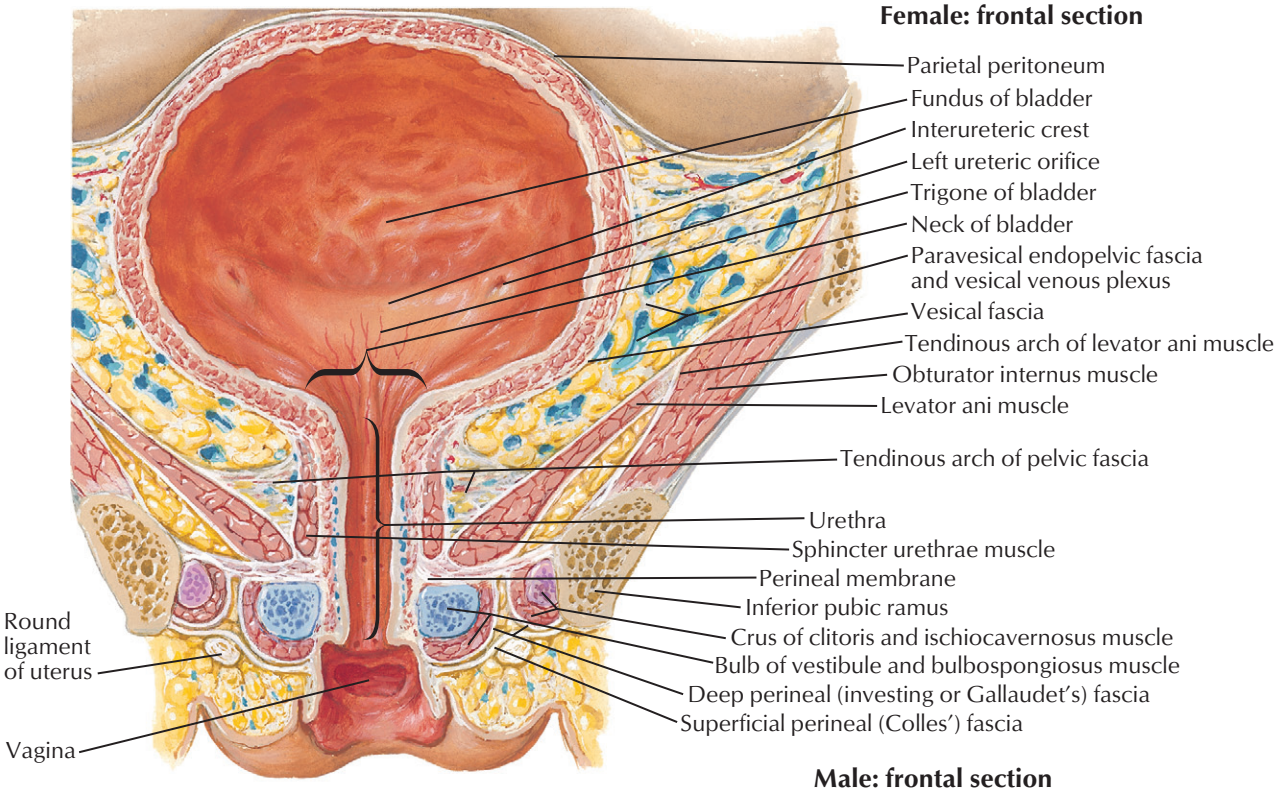
Superior view with peritoneum and vesical fascia removed



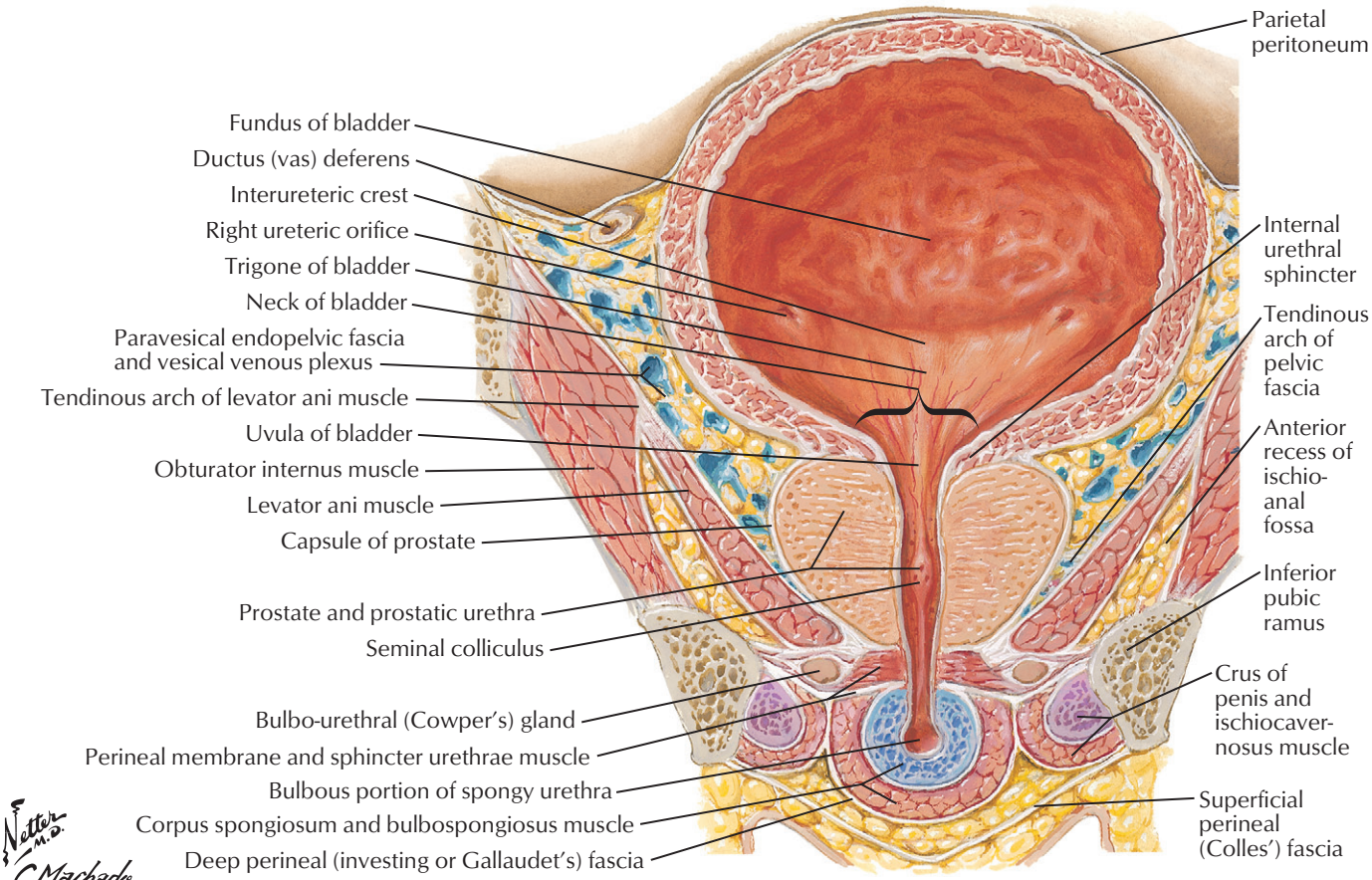

Trigonal ring
Posterior loop
Loop of Heiss
Bladder
Vagina
Urethra
Levator ani muscle
Urogenital hiatus
Sphincter urethrae muscle
Urethrovaginal muscle
Compressor urethrae muscle
External urethral sphincter (voluntary)
Perineal body
Pubic bone
JOHN A. CRAIG, MD
C. Machado, M.D.

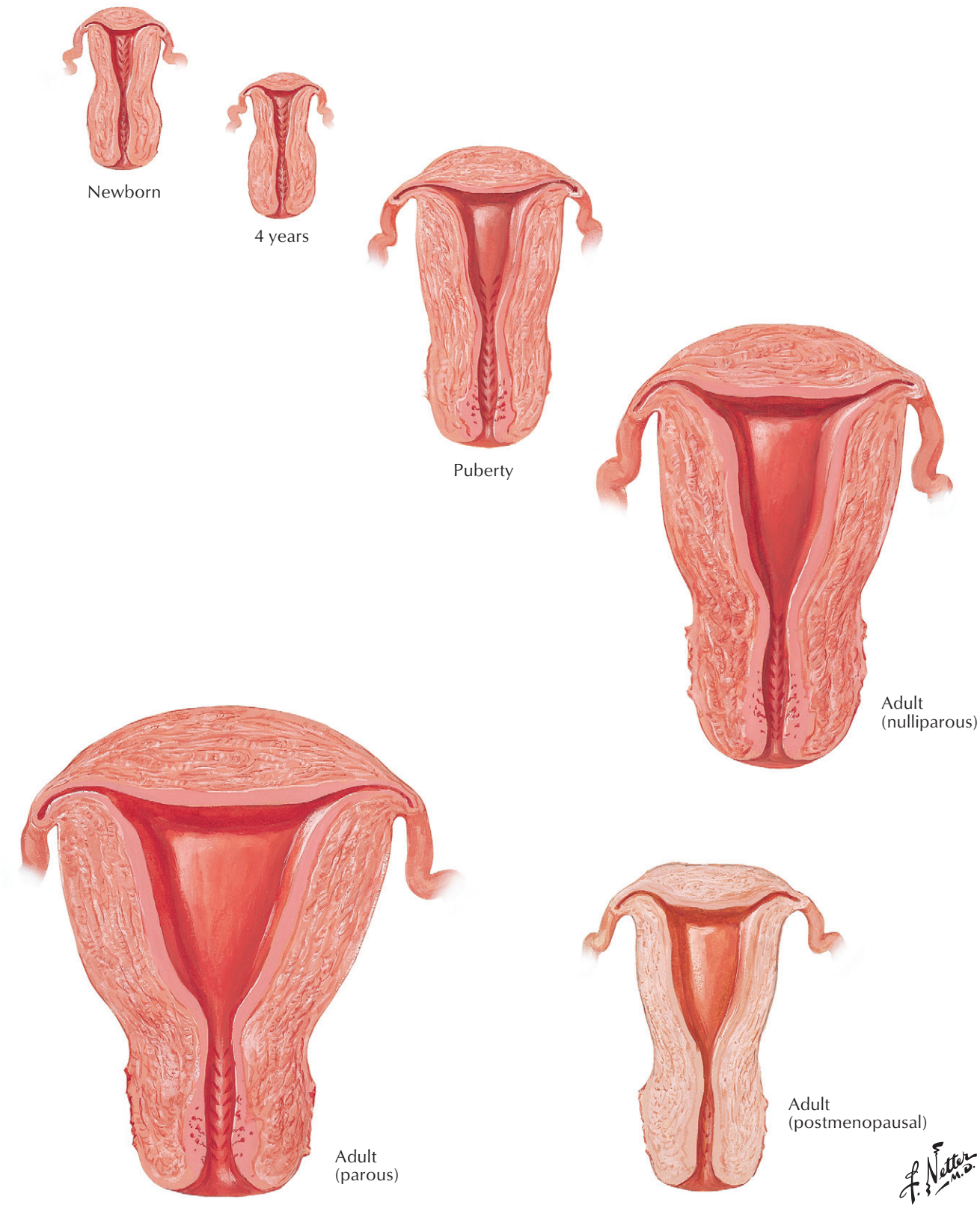
See also **Plates 340, 344, 381**

Female: frontal section

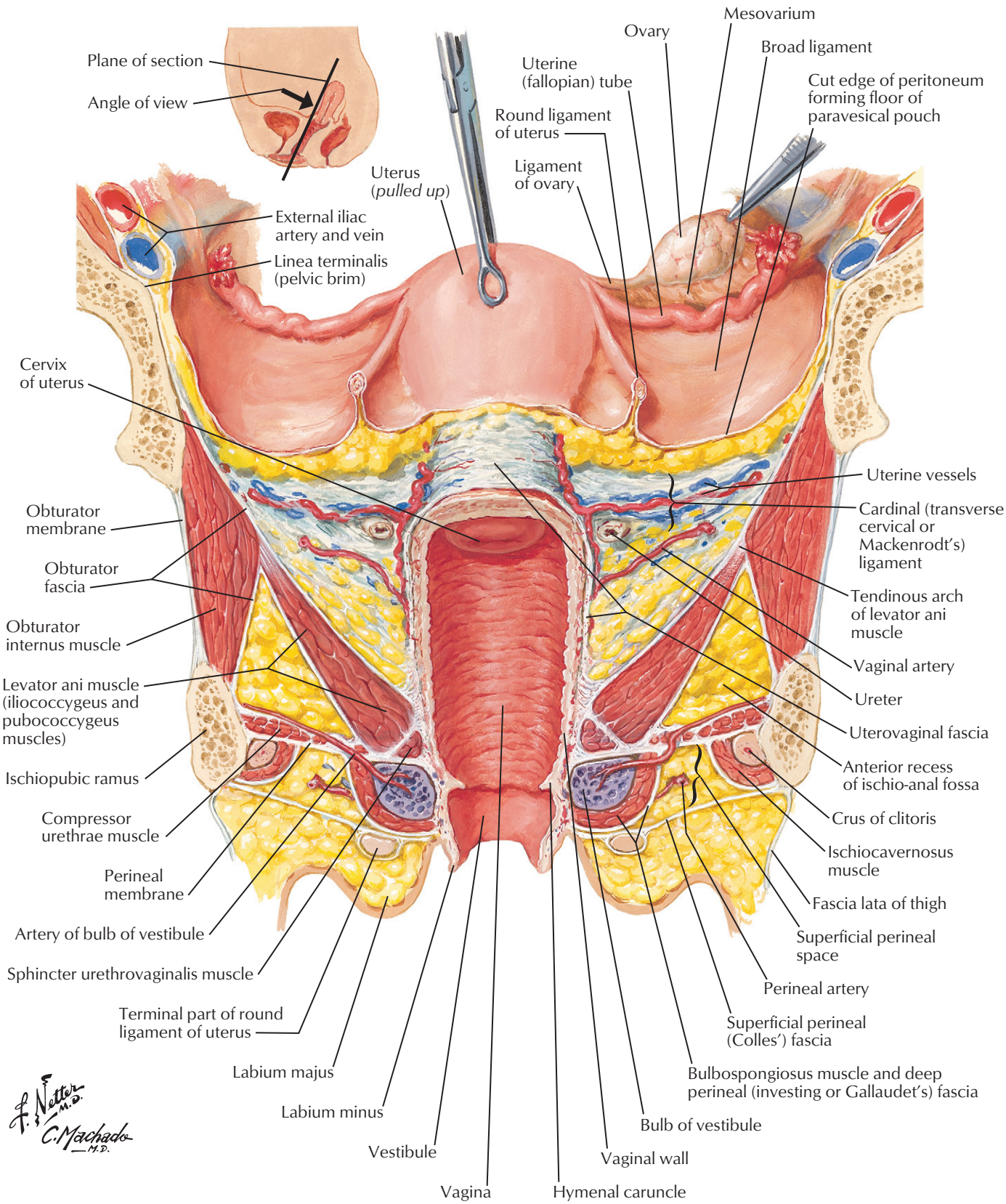


Male: frontal section

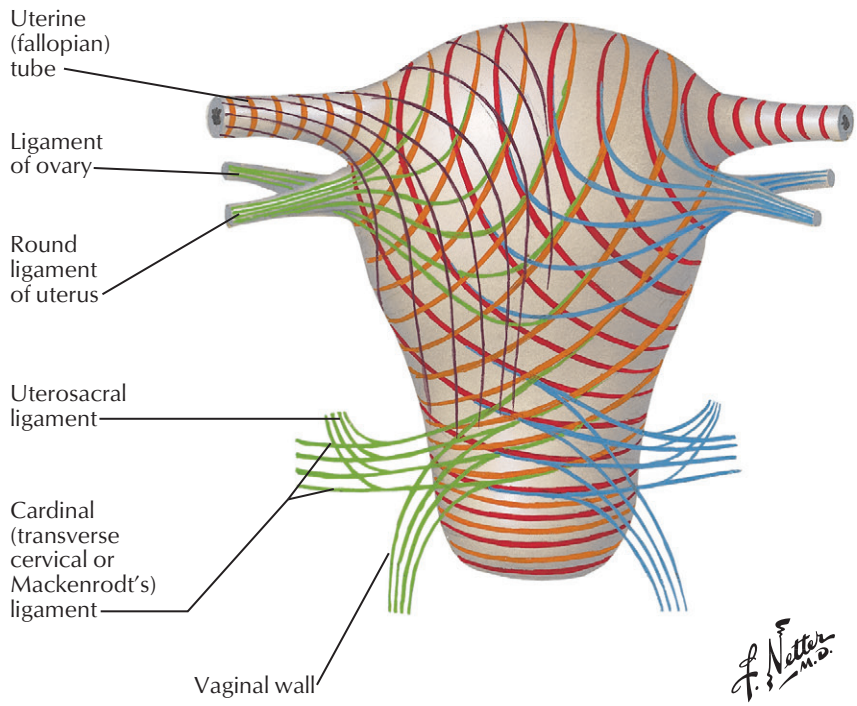



Newborn
4 years
Puberty
Adult
(nulliparous)
Adult
(parous)
Adult
(postmenopausal)
F. Netter M.D.

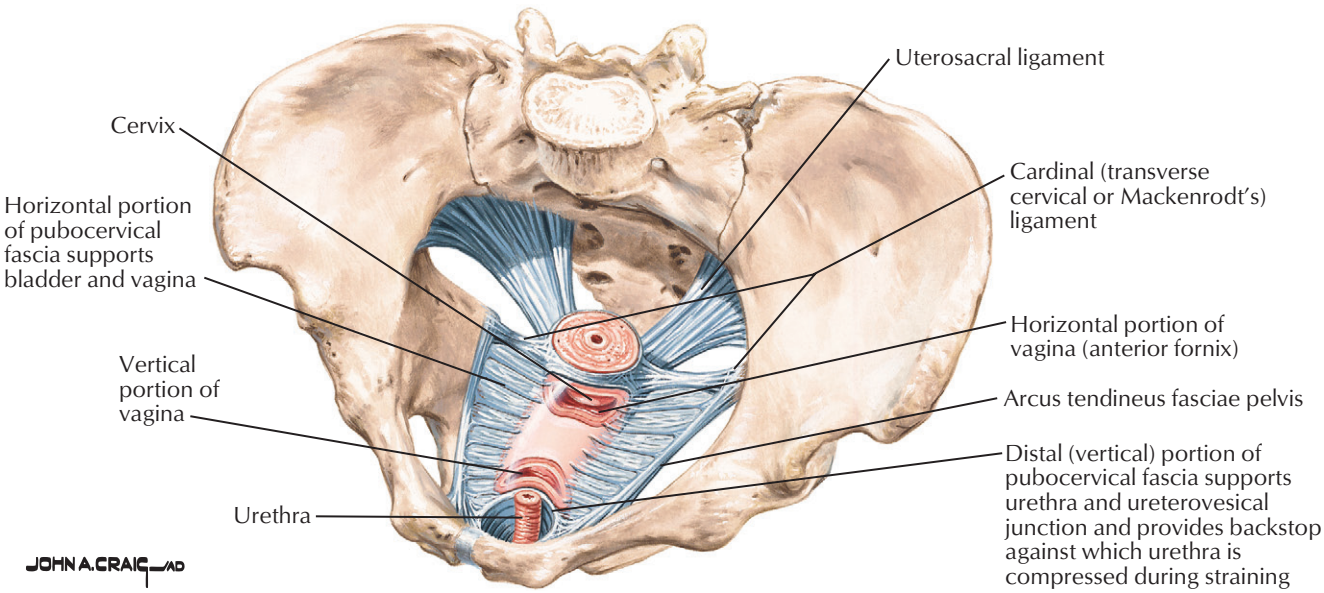
See also **Plates 382, 384, 390**

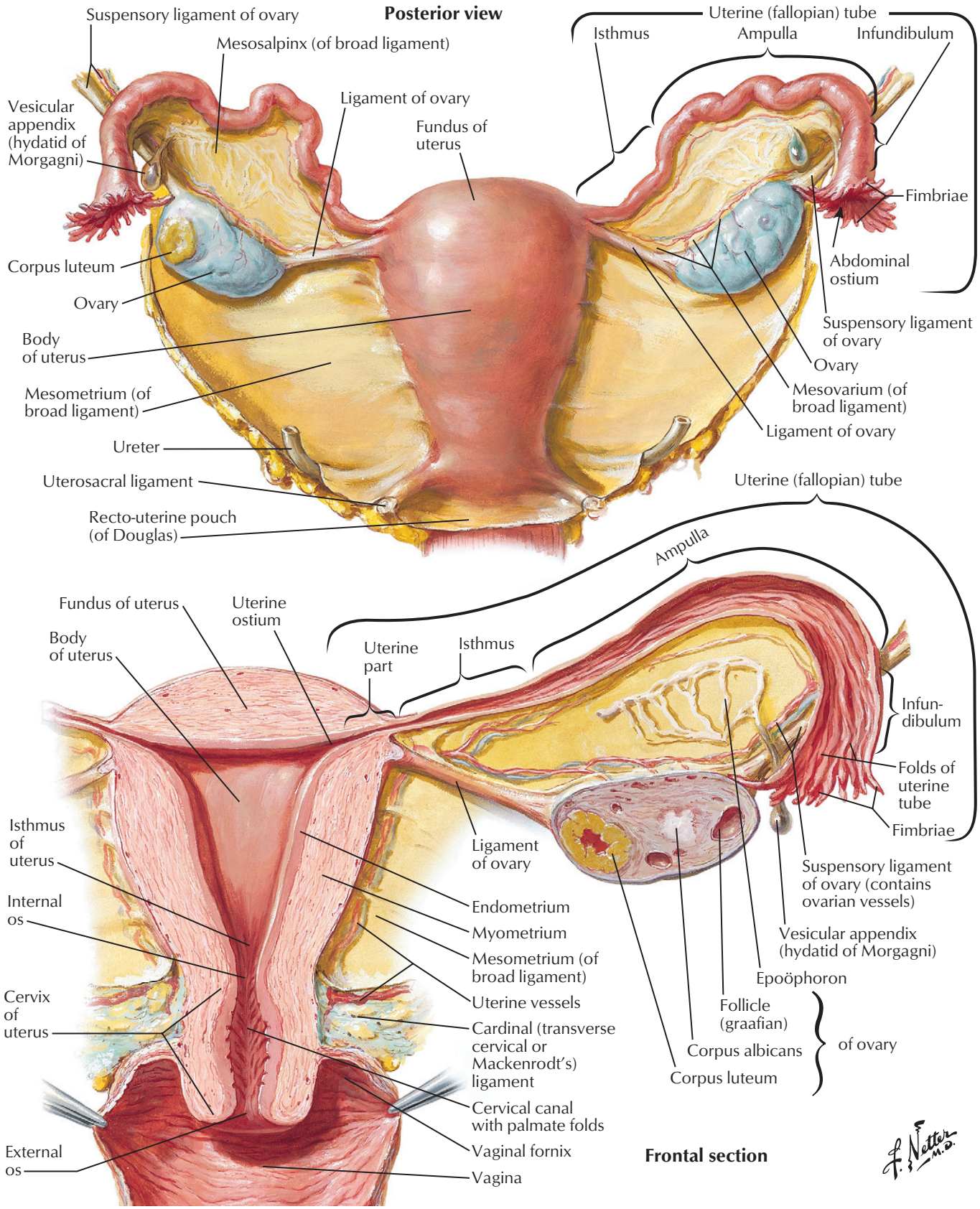


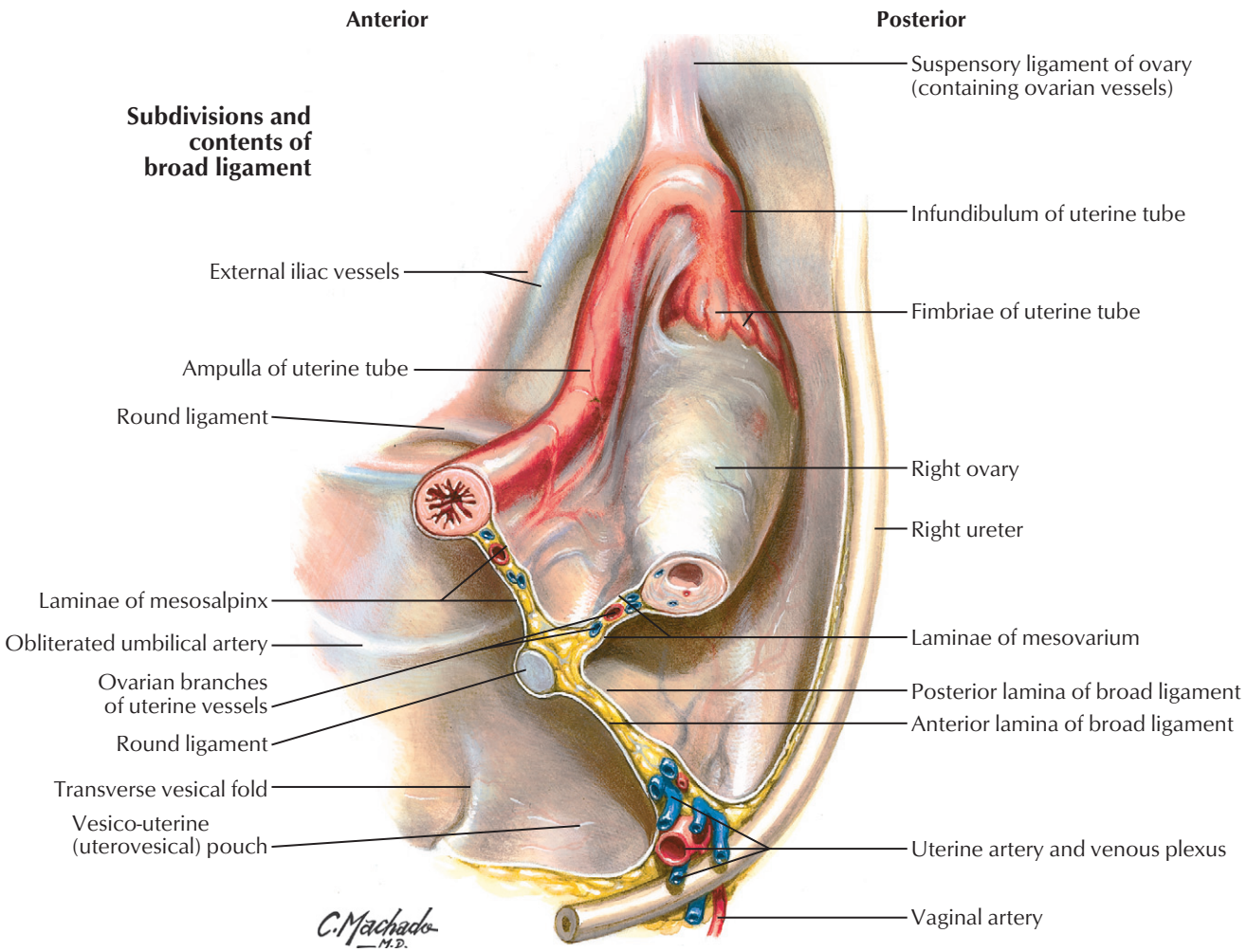
Fascial ligaments of uterus

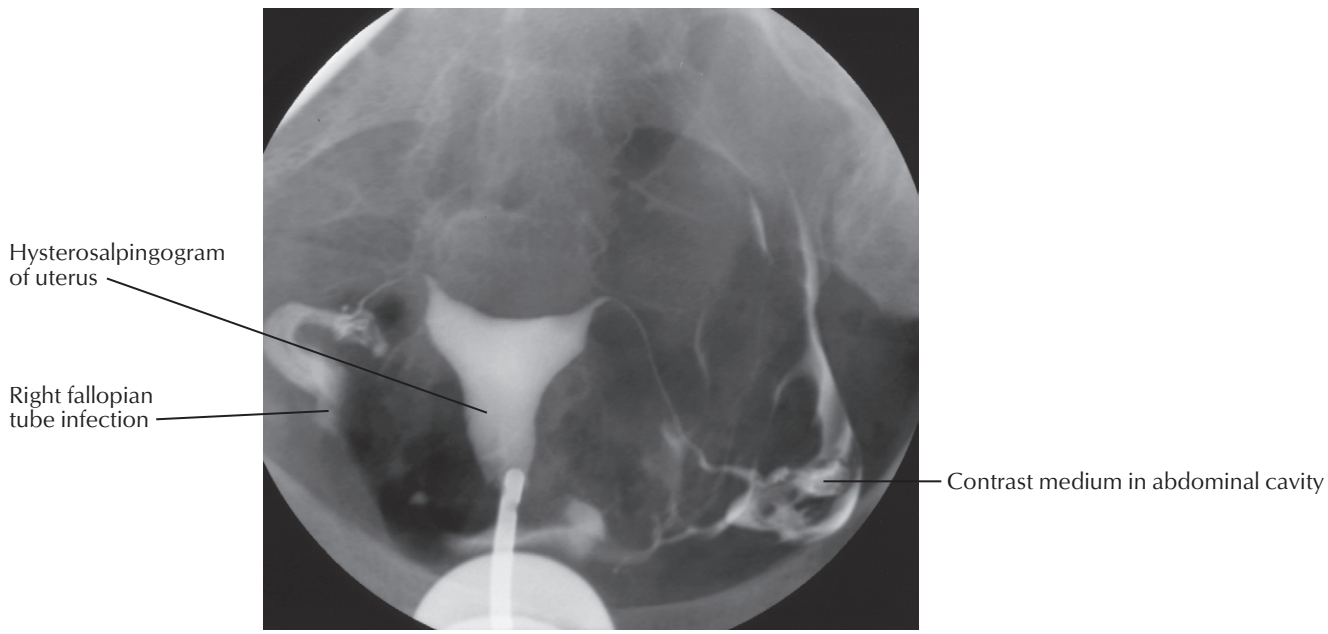


Pelvic fascia and ligaments



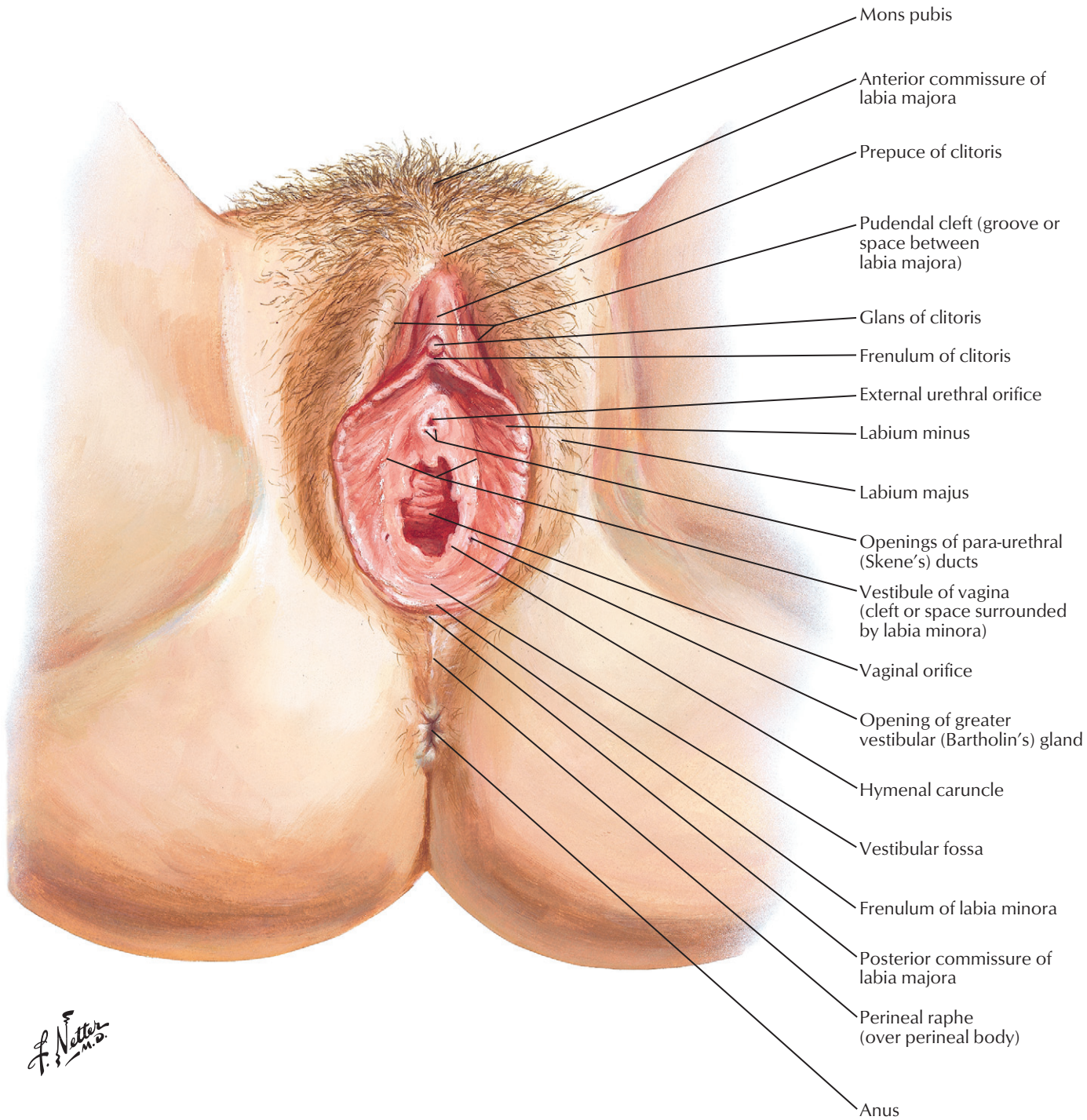

Posterior view
Suspensory ligament of ovary
Mesosalpinx (of broad ligament)
Vesicular appendix (hydatid of Morgagni)
Ligament of ovary
Fundus of uterus
Uterine (fallopian) tube
Isthmus
Ampulla
Infundibulum
Fimbriae
Corpus luteum
Ovary
Body of uterus
Mesometrium (of broad ligament)
Ureter
Uterosacral ligament
Recto-uterine pouch (of Douglas)
Abdominal ostium
Suspensory ligament of ovary
Ovary
Mesovarium (of broad ligament)
Ligament of ovary
Uterine (fallopian) tube
Ampulla
Fundus of uterus
Uterine ostium
Body of uterus
Uterine part
Isthmus
Infun-dibulum
Folds of uterine tube
Fimbriae
Isthmus of uterus
Internal os
Cervix of uterus
External os
Ligament of ovary
Endometrium
Myometrium
Mesometrium (of broad ligament)
Uterine vessels
Cardinal (transverse cervical or Mackenrodt's) ligament
Cervical canal with palmate folds
Vaginal fornix
Vagina
Suspensory ligament of ovary (contains ovarian vessels)
Vesicular appendix (hydatid of Morgagni)
Epoöphoron
Follicle (graafian)
Corpus albicans
Corpus luteum
of ovary
Frontal section

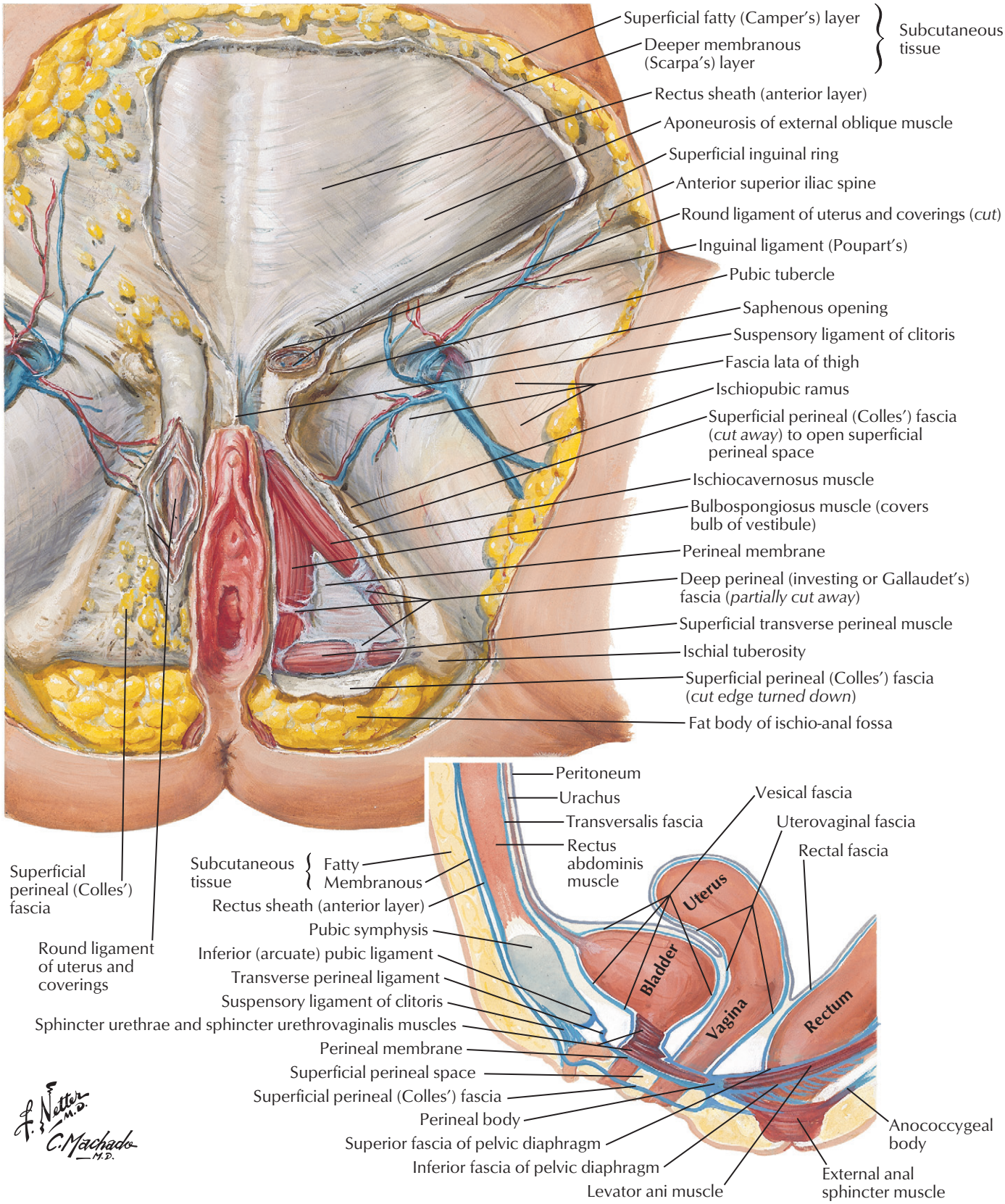

Anterior
Posterior
Subdivisions and contents of broad ligament
Suspensory ligament of ovary (containing ovarian vessels)
Infundibulum of uterine tube
External iliac vessels
Fimbriae of uterine tube
Ampulla of uterine tube
Round ligament
Right ovary
Right ureter
Laminae of mesosalpinx
Obliterated umbilical artery
Laminae of mesovarium
Ovarian branches of uterine vessels
Posterior lamina of broad ligament
Round ligament
Anterior lamina of broad ligament
Transverse vesical fold
Vesico-uterine (uterovesical) pouch
Uterine artery and venous plexus
Vaginal artery
C. Machado M.D.

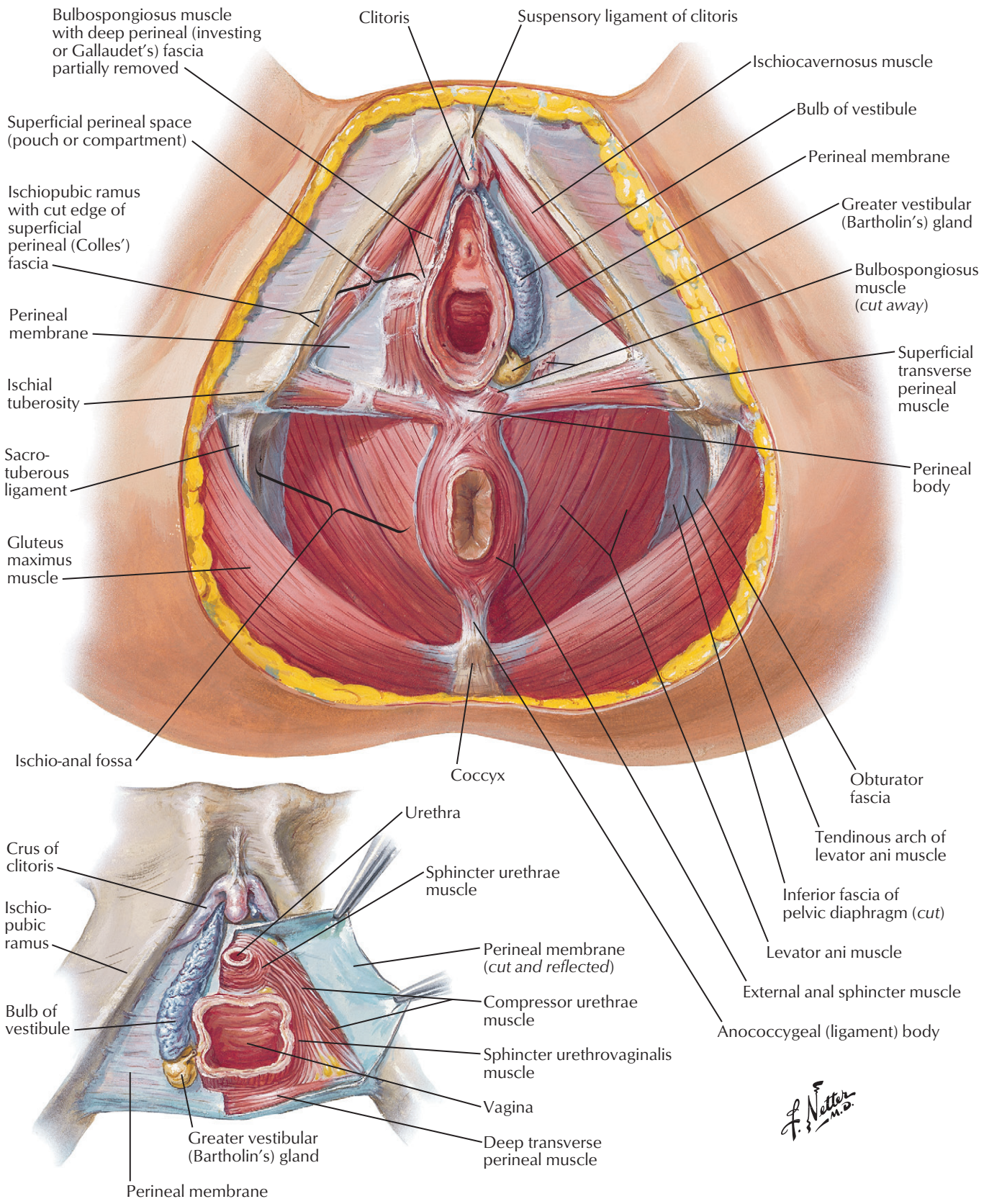

Hysterosalpingogram of uterus
Right fallopian tube infection
Contrast medium in abdominal cavity

Female Perineum and External Genitalia (Pudendum or Vulva)

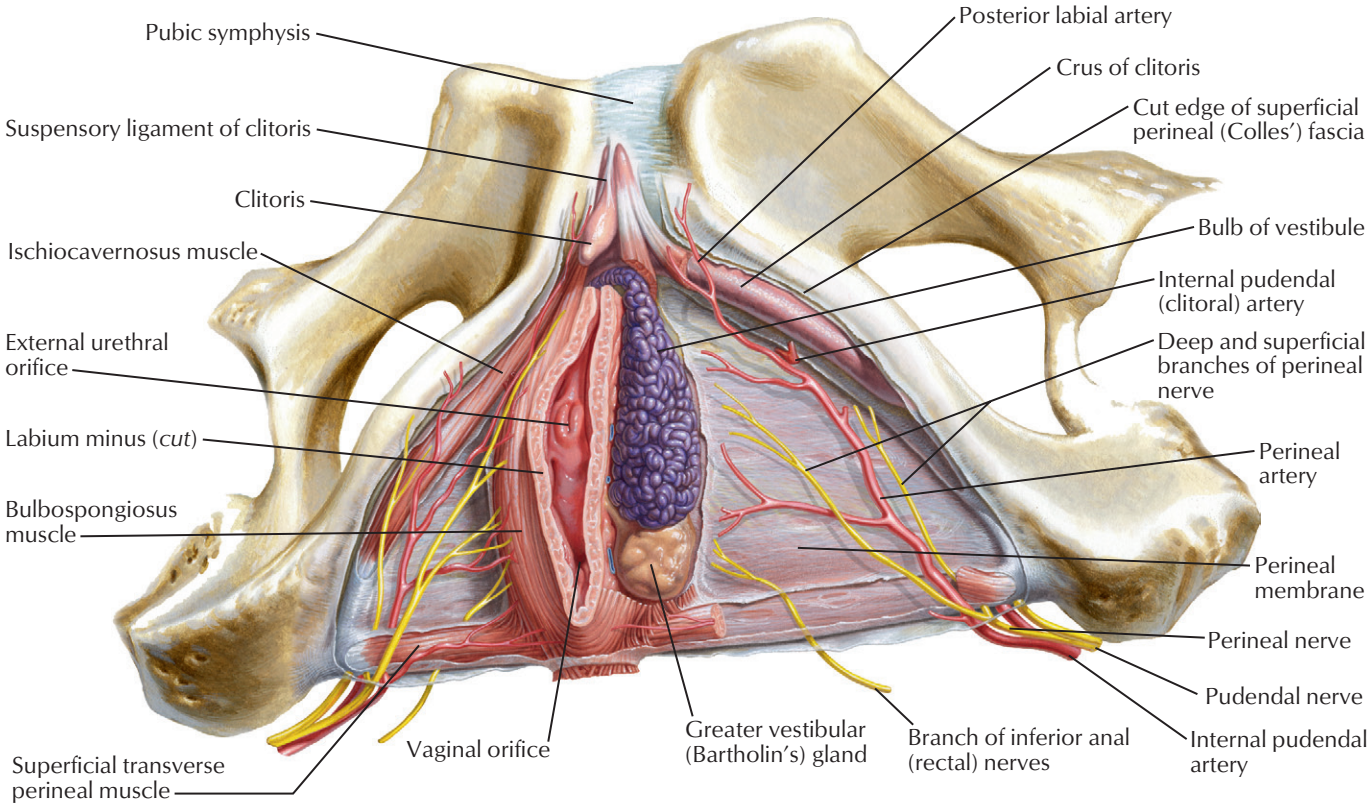
See also **Plates 382, 385, 391**



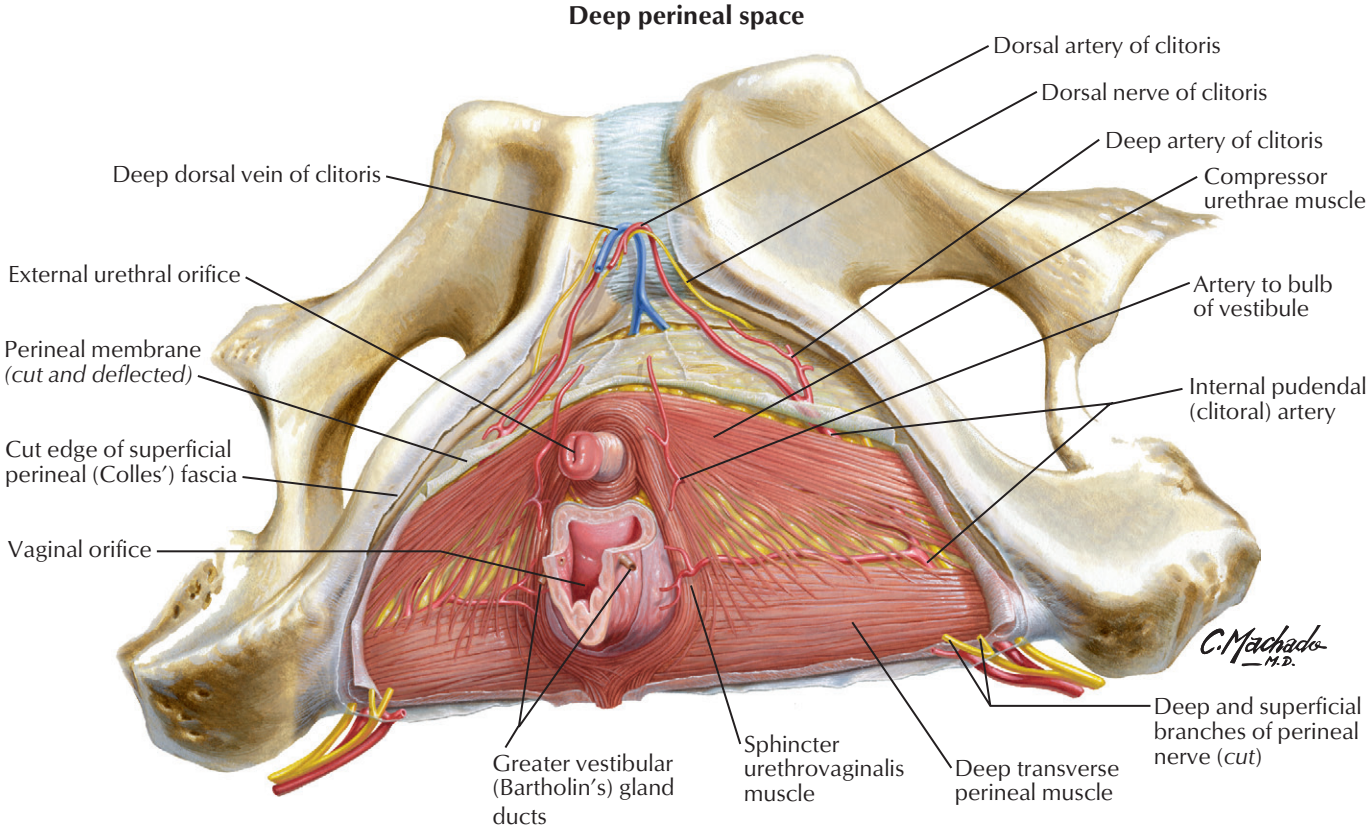

Superficial fatty (Camper's) layer
Deeper membranous (Scarpa's) layer
Subcutaneous tissue
Rectus sheath (anterior layer)
Aponeurosis of external oblique muscle
Superficial inguinal ring
Anterior superior iliac spine
Round ligament of uterus and coverings (cut)
Inguinal ligament (Poupart's)
Pubic tubercle
Saphenous opening
Suspensory ligament of clitoris
Fascia lata of thigh
Ischiopubic ramus
Superficial perineal (Colles') fascia (cut away) to open superficial perineal space
Ischiocavernosus muscle
Bulbospongiosus muscle (covers bulb of vestibule)
Perineal membrane
Deep perineal (investing or Gallaudet's) fascia (partially cut away)
Superficial transverse perineal muscle
Ischial tuberosity
Superficial perineal (Colles') fascia (cut edge turned down)
Fat body of ischio-anal fossa
Peritoneum
Urachus
Transversalis fascia
Rectus abdominis muscle
Vesical fascia
Uterovaginal fascia
Rectal fascia
Uterus
Bladder
Vagina
Rectum
Superficial perineal (Colles') fascia
Subcutaneous tissue
Fatty
Membranous
Rectus sheath (anterior layer)
Pubic symphysis
Inferior (arcuate) pubic ligament
Transverse perineal ligament
Suspensory ligament of clitoris
Sphincter urethrae and sphincter urethrovaginalis muscles
Perineal membrane
Superficial perineal space
Superficial perineal (Colles') fascia
Perineal body
Superior fascia of pelvic diaphragm
Inferior fascia of pelvic diaphragm
Levator ani muscle
Round ligament of uterus and coverings
Anococcygeal body
External anal sphincter muscle
F. Netter M.D.
C. Machado M.D.

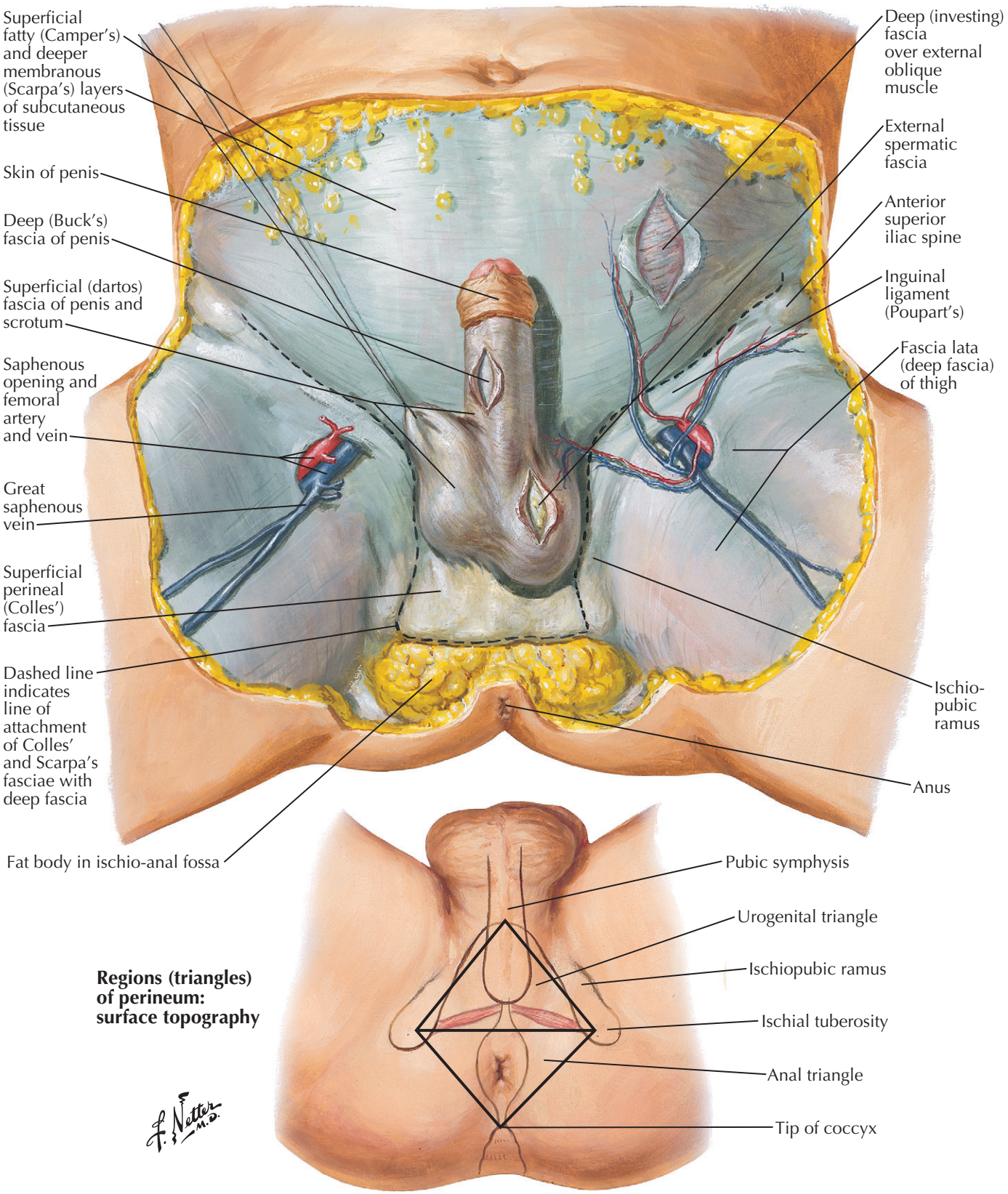

Bulbospongiosus muscle with deep perineal (investing or Gallaudet's) fascia partially removed
Clitoris
Suspensory ligament of clitoris
Ischiocavernosus muscle
Bulb of vestibule
Perineal membrane
Greater vestibular (Bartholin's) gland
Bulbospongiosus muscle (*cut away*)
Superficial transverse perineal muscle
Perineal body
Superficial perineal space (pouch or compartment)
Ischiopubic ramus with cut edge of superficial perineal (Colles') fascia
Perineal membrane
Ischial tuberosity
Sacro-tuberous ligament
Gluteus maximus muscle
Ischio-anal fossa
Coccyx
Obturator fascia
Tendinous arch of levator ani muscle
Inferior fascia of pelvic diaphragm (*cut*)
Levator ani muscle
External anal sphincter muscle
Anococcygeal (ligament) body
Urethra
Crus of clitoris
Sphincter urethrae muscle
Ischio-pubic ramus
Perineal membrane (*cut and reflected*)
Compressor urethrae muscle
Bulb of vestibule
Sphincter urethrovaginalis muscle
Vagina
Greater vestibular (Bartholin's) gland
Deep transverse perineal muscle
Perineal membrane

Superficial perineal space

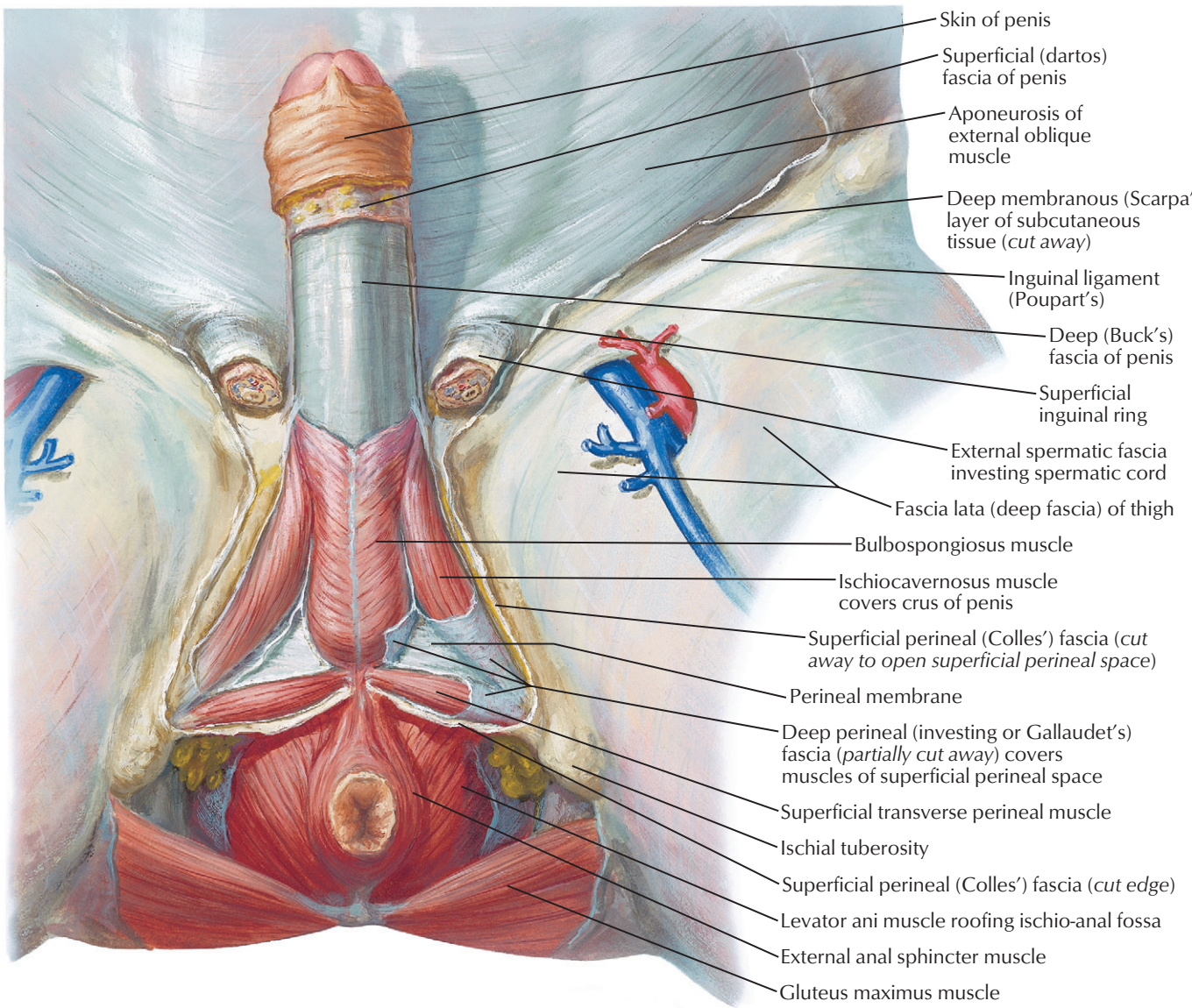


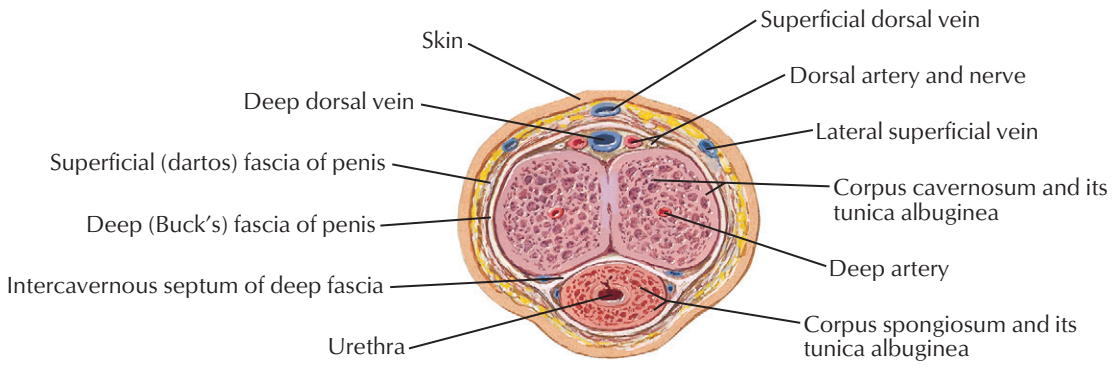
Deep perineal space



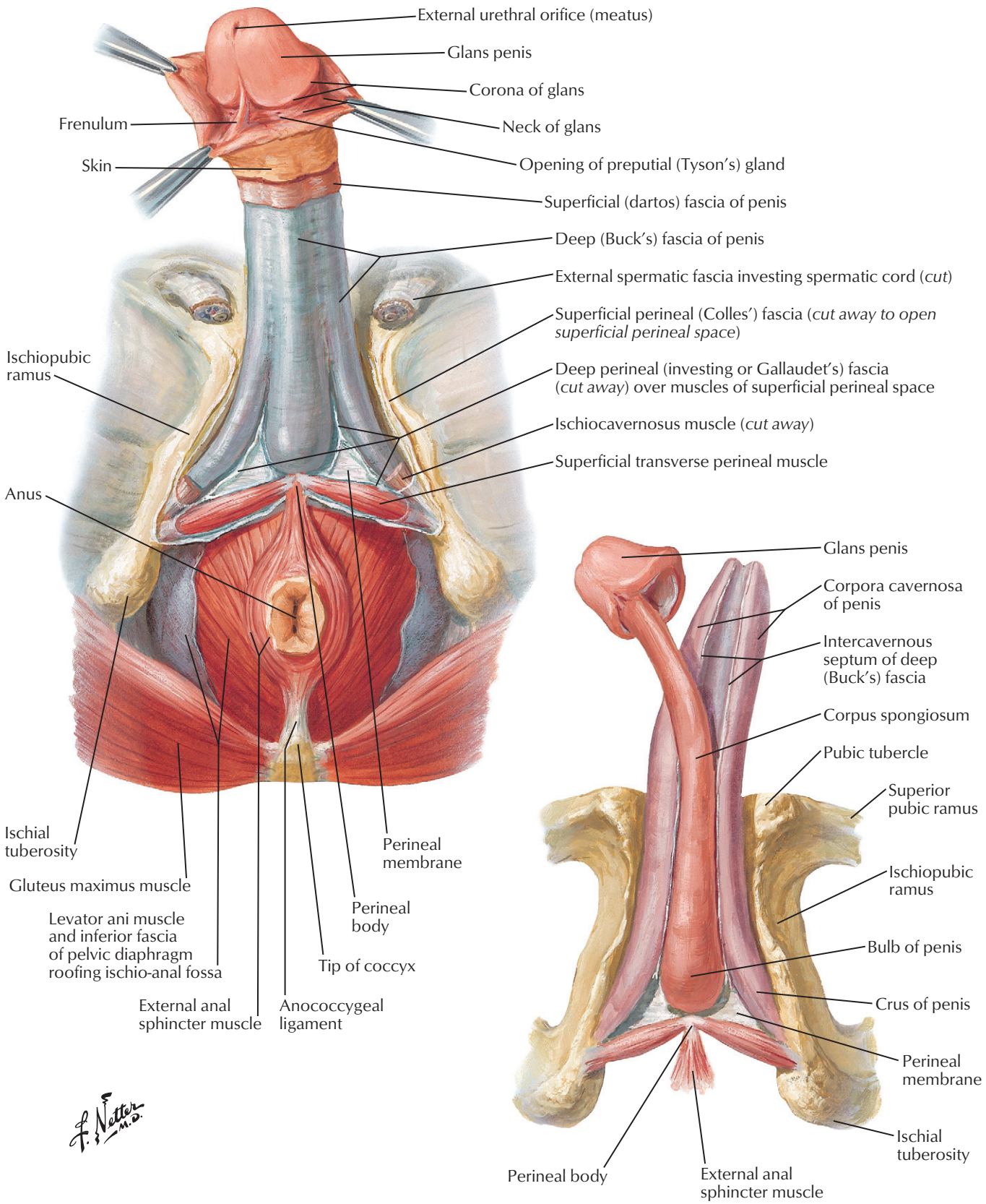


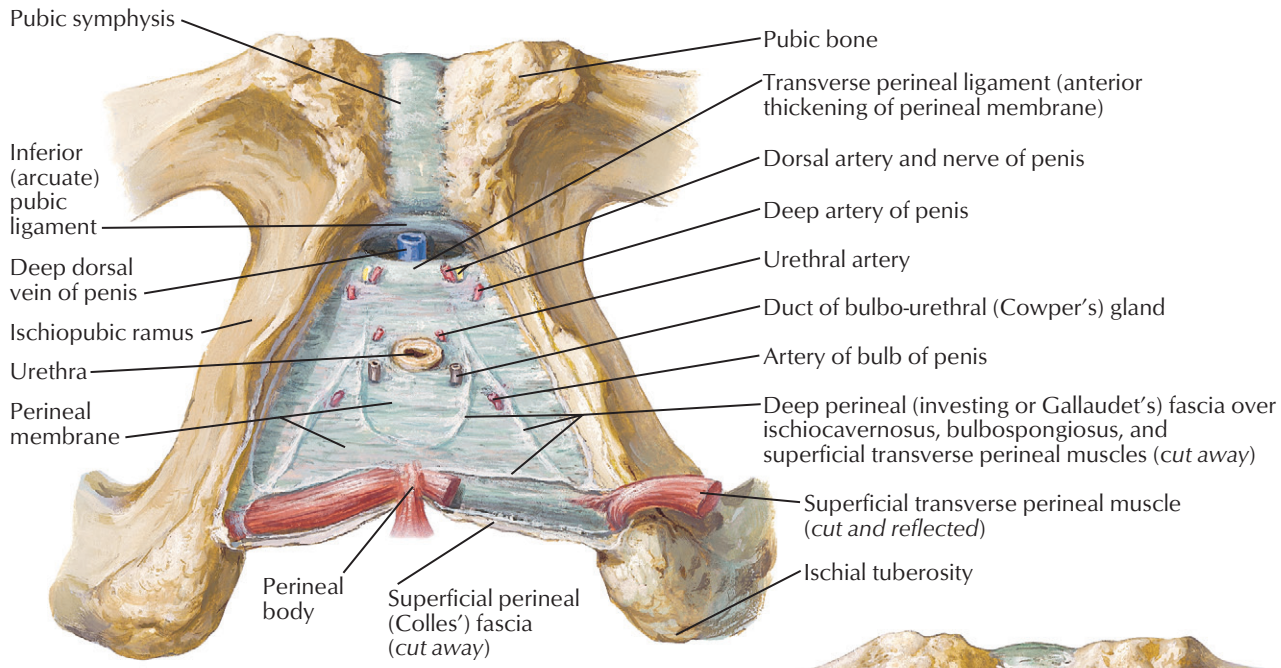
Regions (triangles) of perineum: surface topography



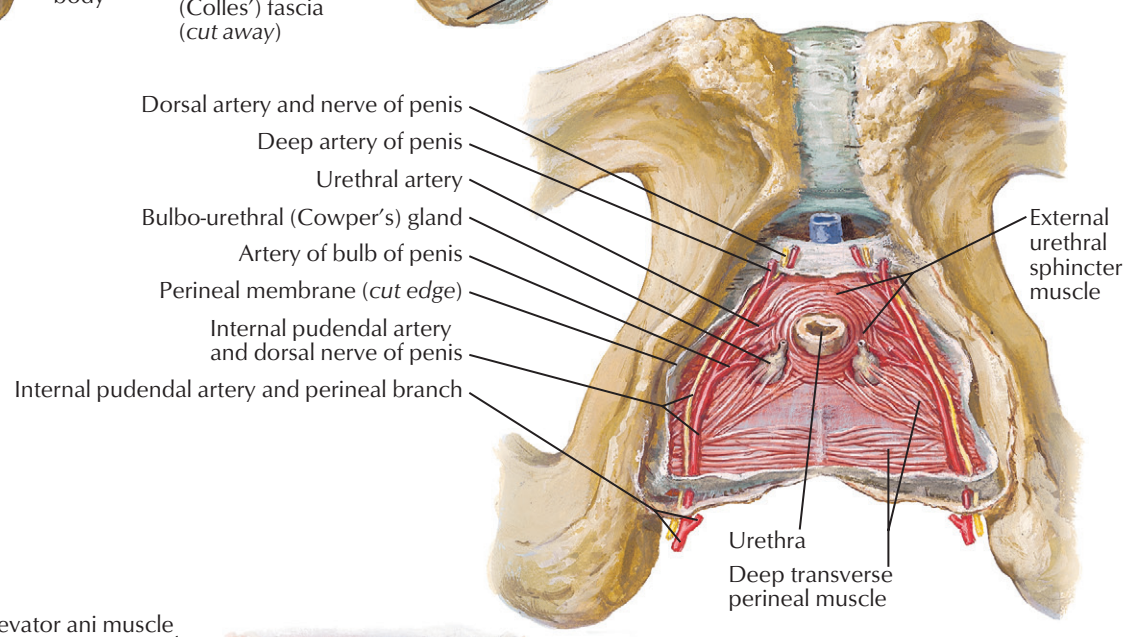


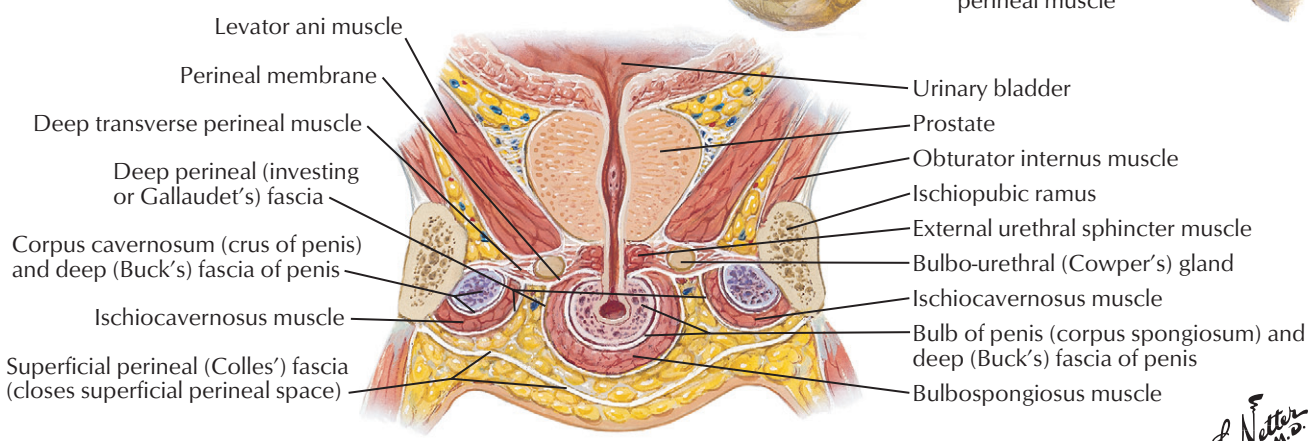
Transverse section through body of penis


External urethral orifice (meatus)
Glans penis
Corona of glans
Frenulum
Neck of glans
Skin
Opening of preputial (Tyson's) gland
Superficial (dartos) fascia of penis
Deep (Buck's) fascia of penis
External spermatic fascia investing spermatic cord (cut)
Superficial perineal (Colles') fascia (cut away to open superficial perineal space)
Ischiopubic ramus
Deep perineal (investing or Gallaudet's) fascia (cut away) over muscles of superficial perineal space
Ischiocavernosus muscle (cut away)
Superficial transverse perineal muscle
Anus
Ischial tuberosity
Perineal membrane
Gluteus maximus muscle
Perineal body
Levator ani muscle and inferior fascia of pelvic diaphragm roofing ischio-anal fossa
Tip of coccyx
External anal sphincter muscle
Anococcygeal ligament
Glans penis
Corpora cavernosa of penis
Intercavernous septum of deep (Buck's) fascia
Corpus spongiosum
Pubic tubercle
Superior pubic ramus
Ischiopubic ramus
Bulb of penis
Crus of penis
Perineal membrane
Ischial tuberosity
Perineal body
External anal sphincter muscle



Inferior views



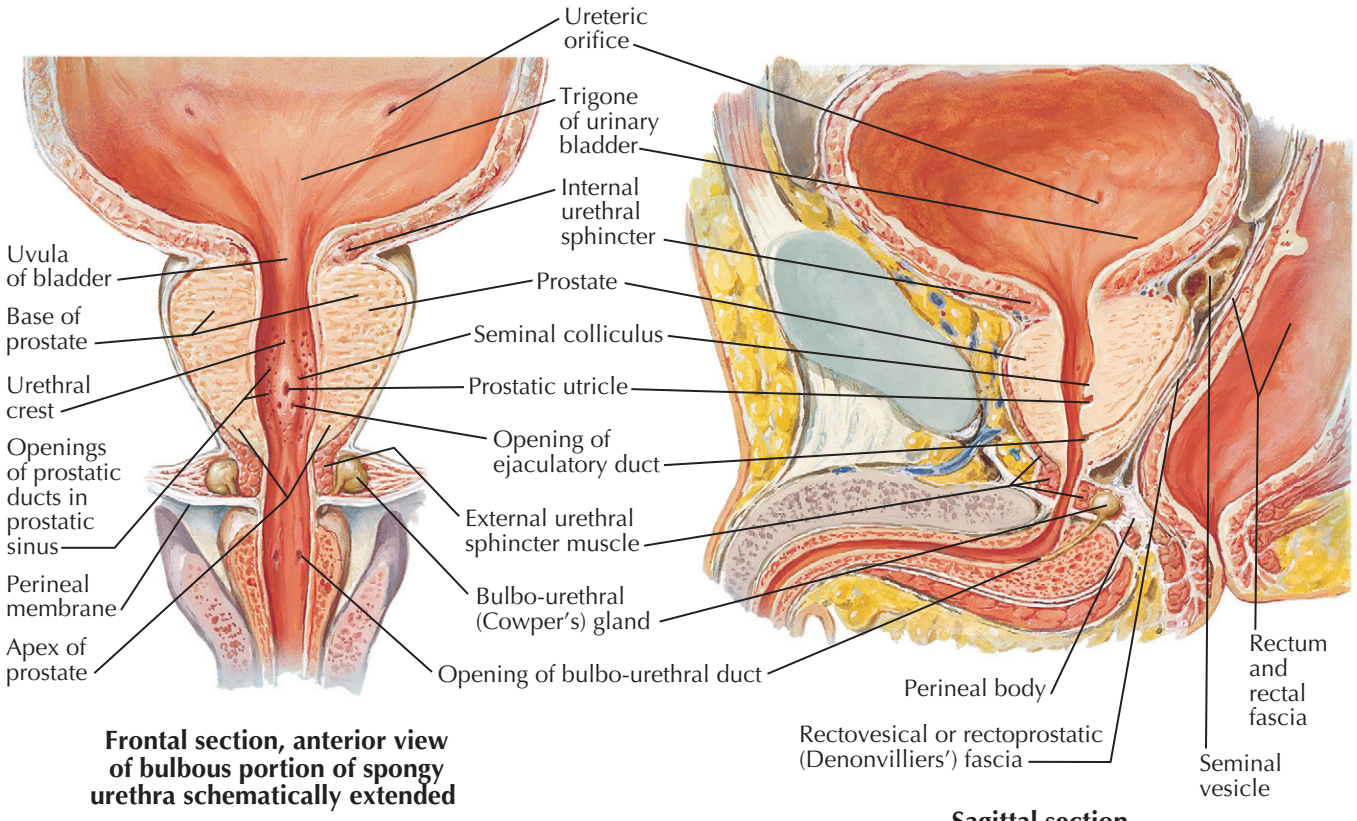


Frontal section, anterior view of perineum: schema

F. Netter M.D. C. Machado M.D.

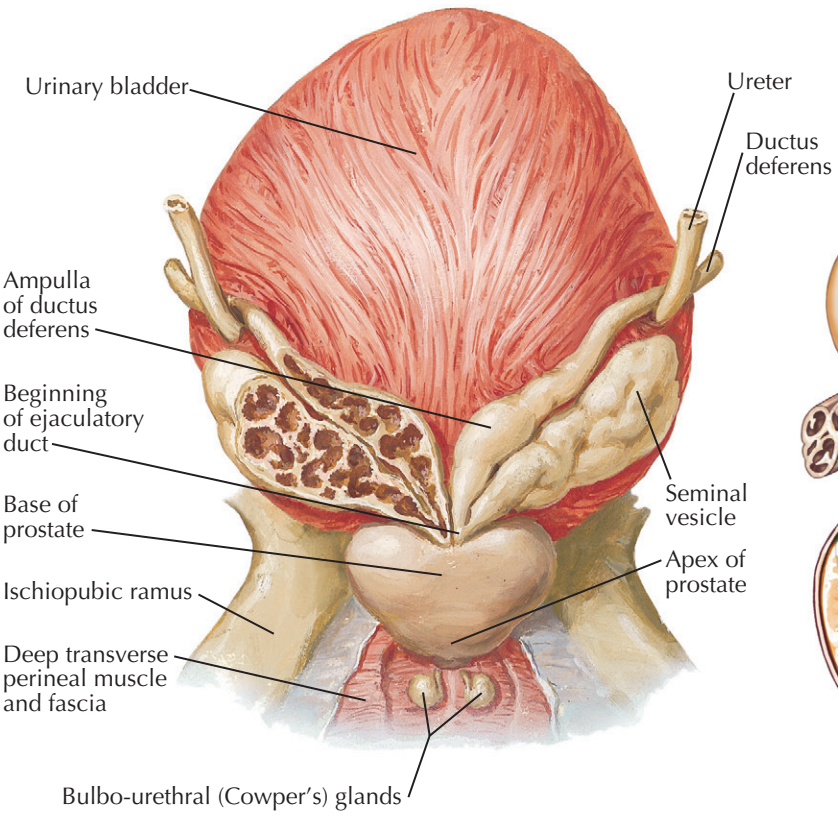
Prostate and Seminal Vesicles

See also **Plates 344, 348, 381**

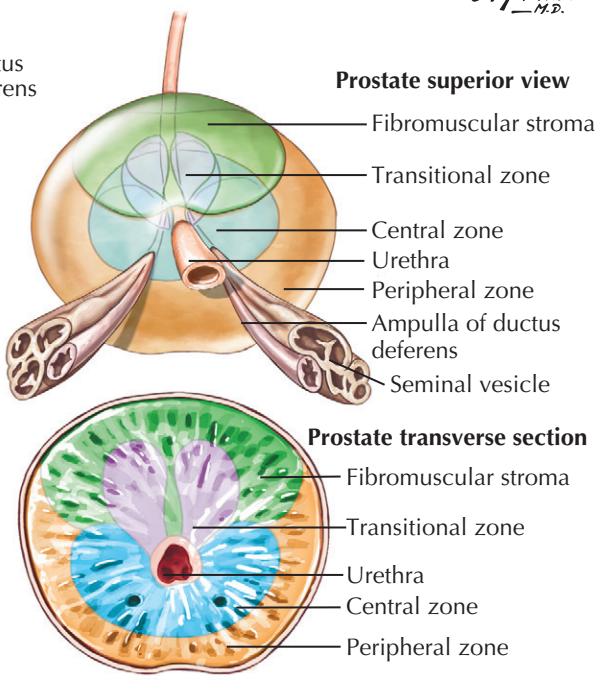


Frontal section, anterior view of bulbous portion of spongy urethra schematically extended

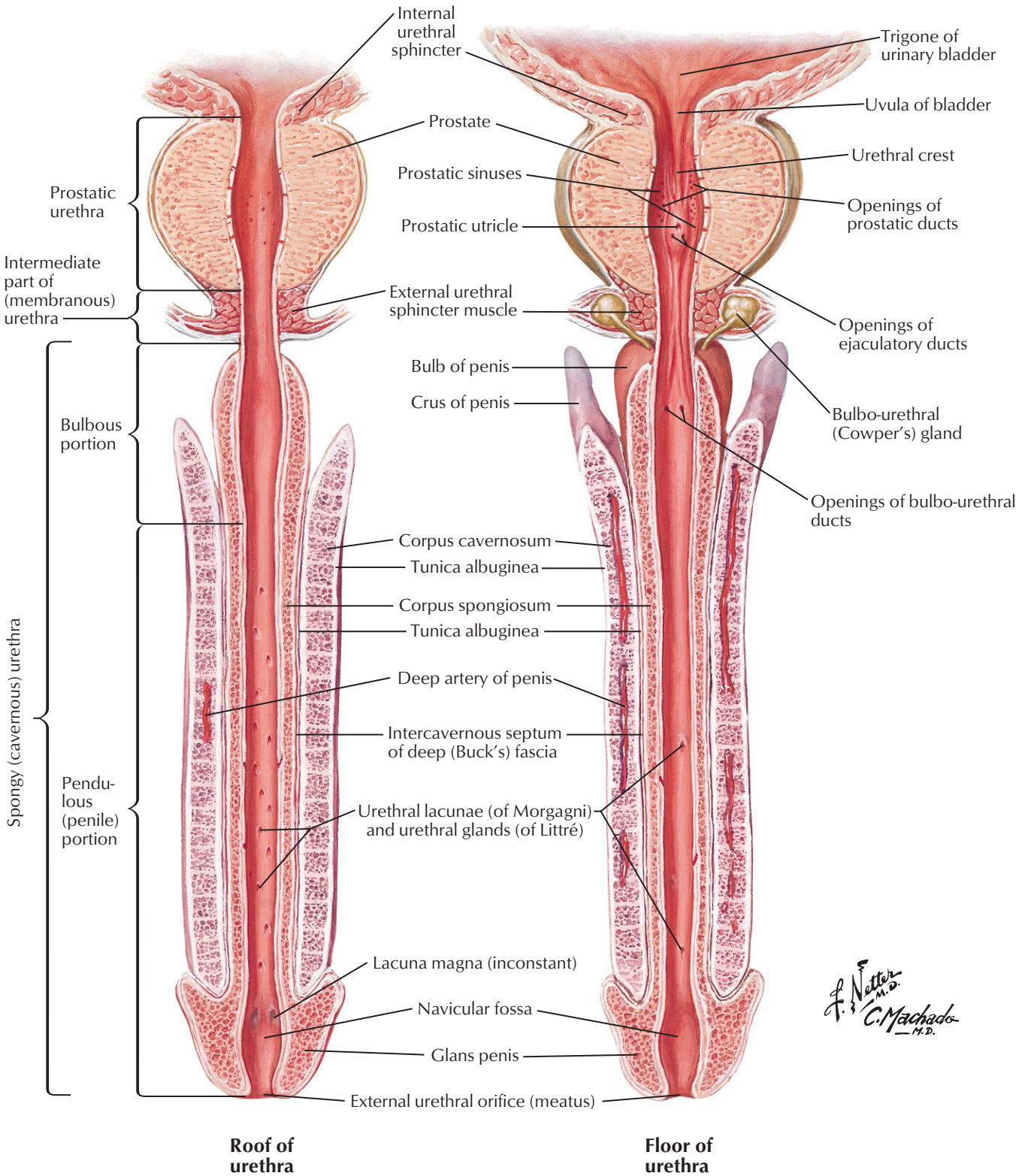
Sagittal section

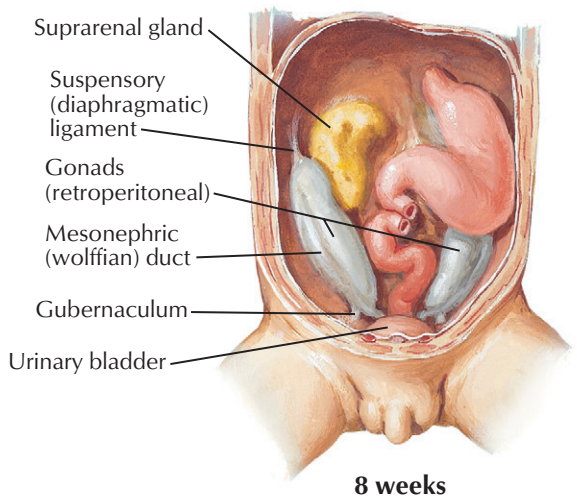


Posterior view

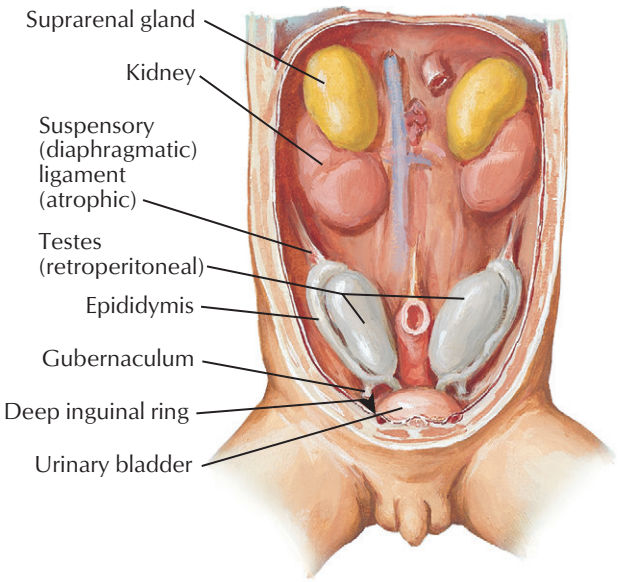


Posterior view

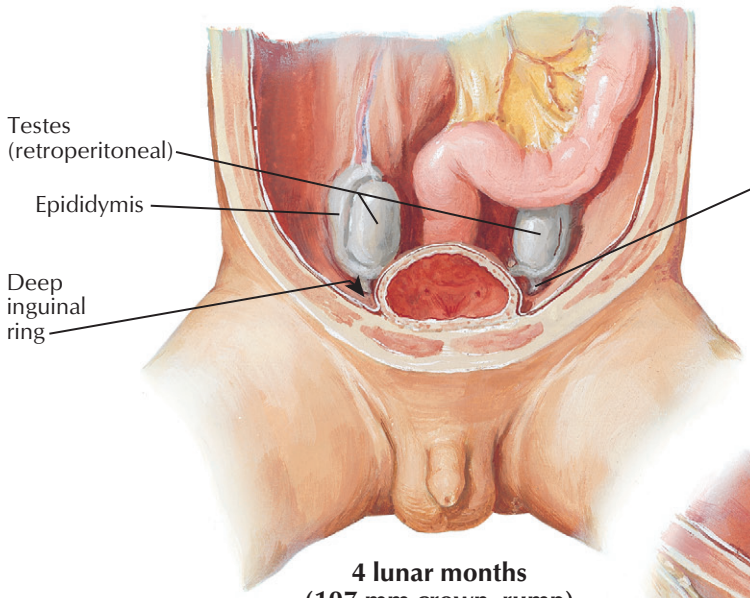

Internal urethral sphincter
Prostate
Prostatic sinuses
Prostatic utricle
External urethral sphincter muscle
Bulb of penis
Crus of penis
Corpus cavernosum
Tunica albuginea
Corpus spongiosum
Tunica albuginea
Deep artery of penis
Intercavernous septum of deep (Buck's) fascia
Urethral lacunae (of Morgagni) and urethral glands (of Littré)
Lacuna magna (inconstant)
Navicular fossa
Glans penis
External urethral orifice (meatus)
Trigone of urinary bladder
Uvula of bladder
Urethral crest
Openings of prostatic ducts
Openings of ejaculatory ducts
Bulbo-urethral (Cowper's) gland
Openings of bulbo-urethral ducts
Prostatic urethra
Intermediate part of (membranous) urethra
Bulbous portion
Pendulous (penile) portion
Spongy (cavernous) urethra
Roof of urethra
Floor of urethra
F. Netter M.D.
C. Machado M.D.



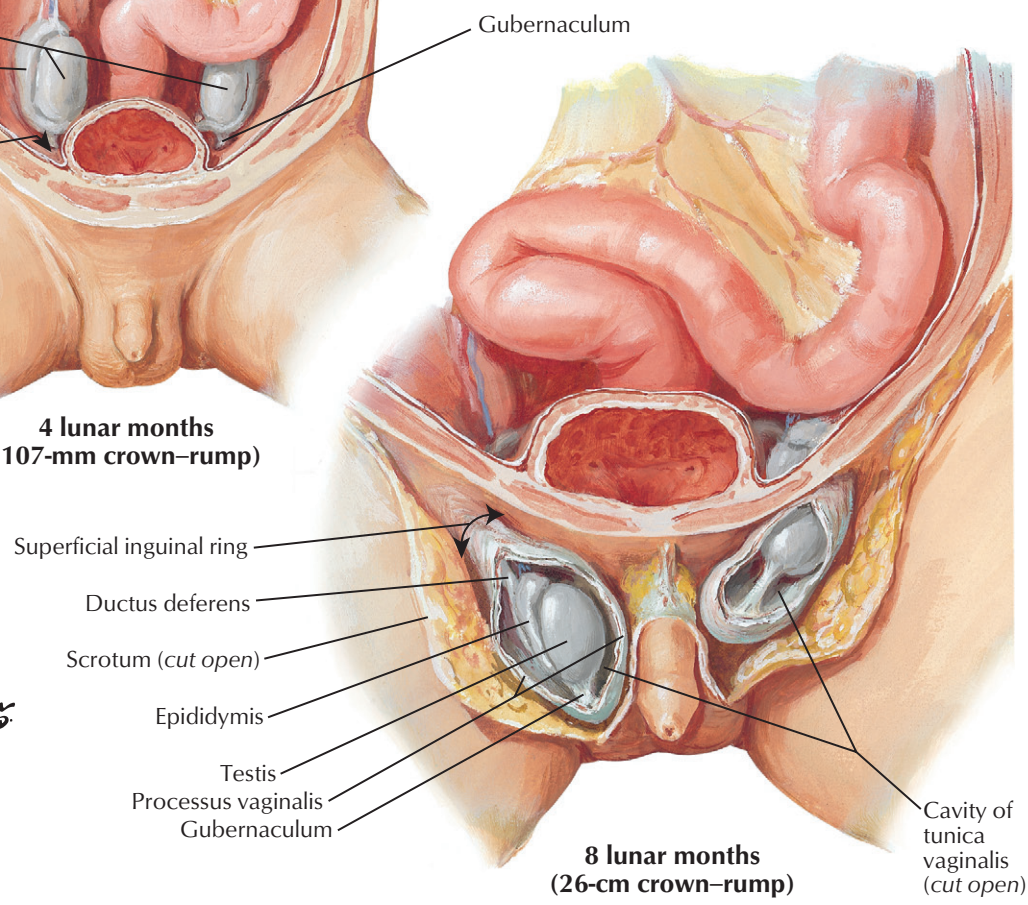
8 weeks
(22.5-mm crown–rump)



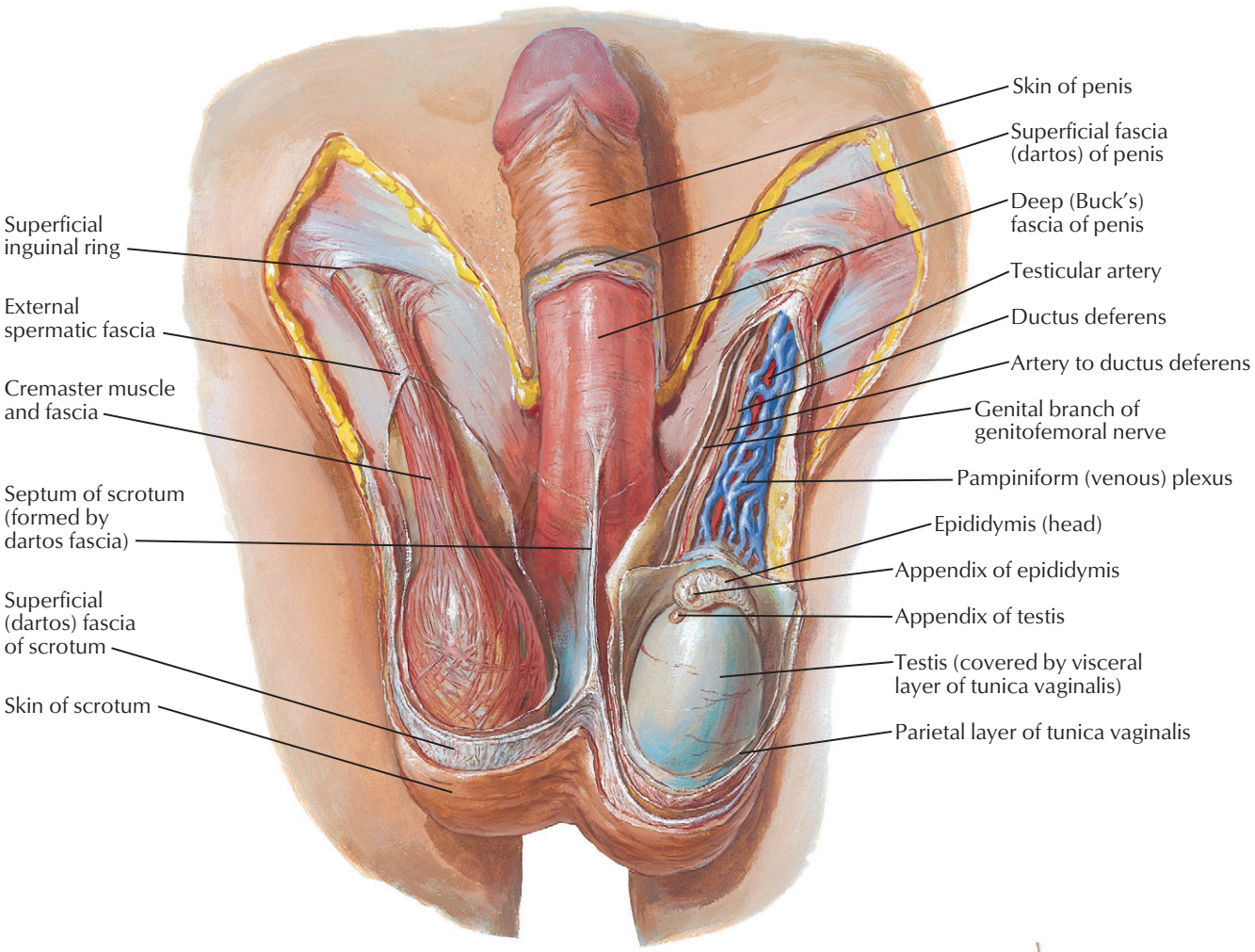
11 weeks
(43-mm crown–rump)

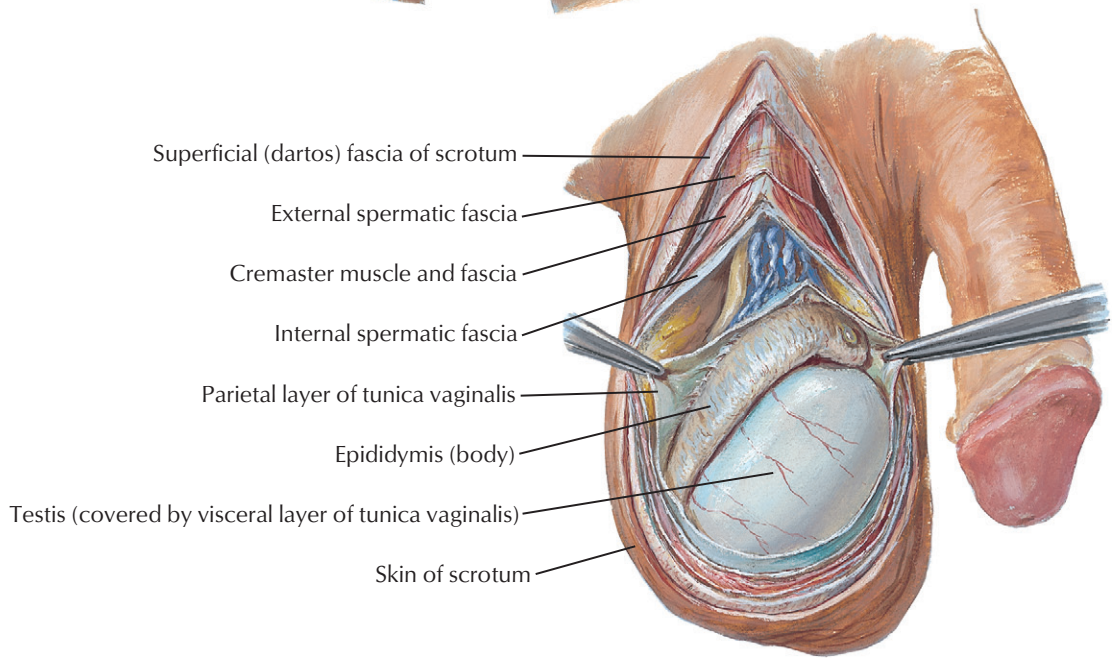


4 lunar months
(107-mm crown–rump)

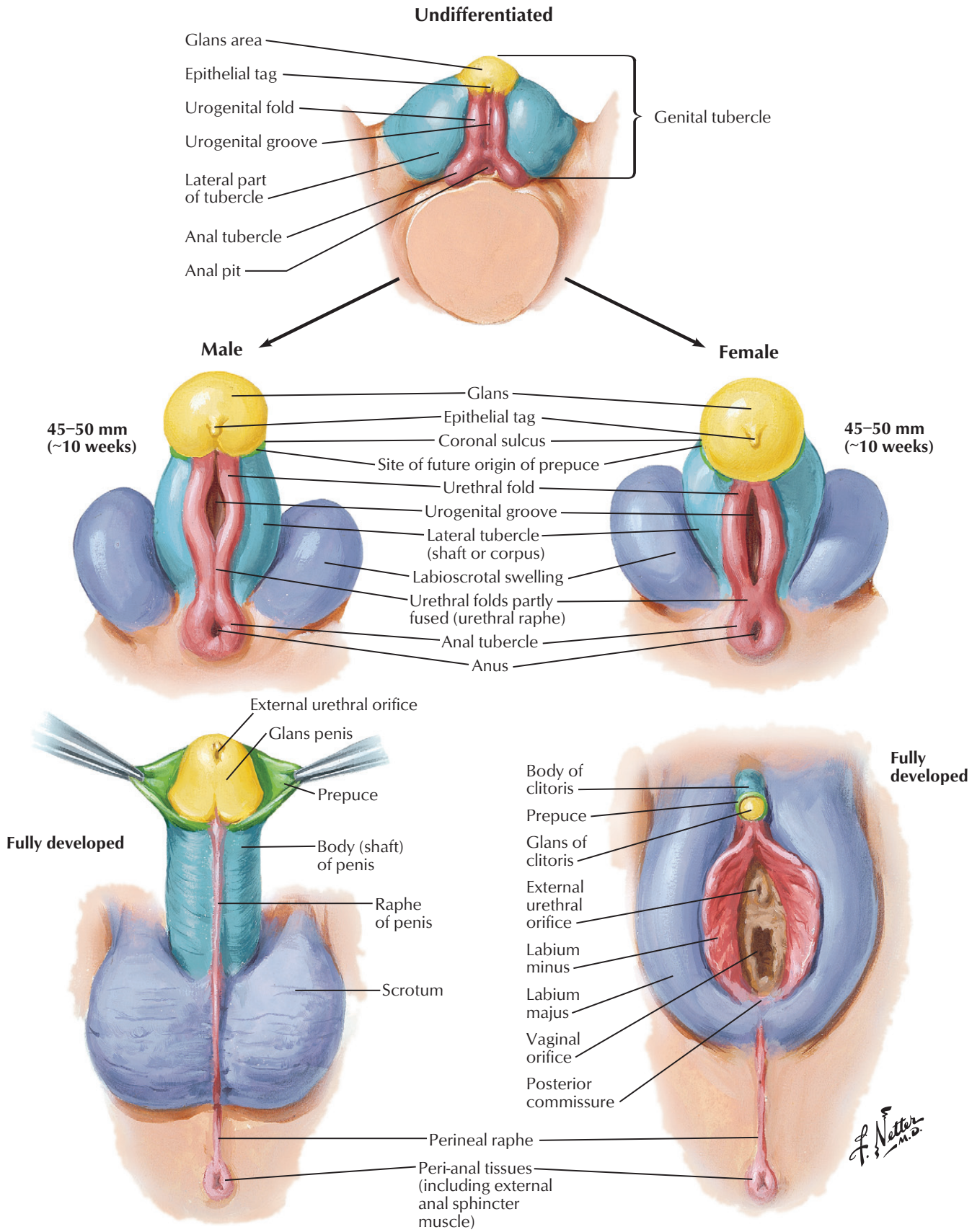


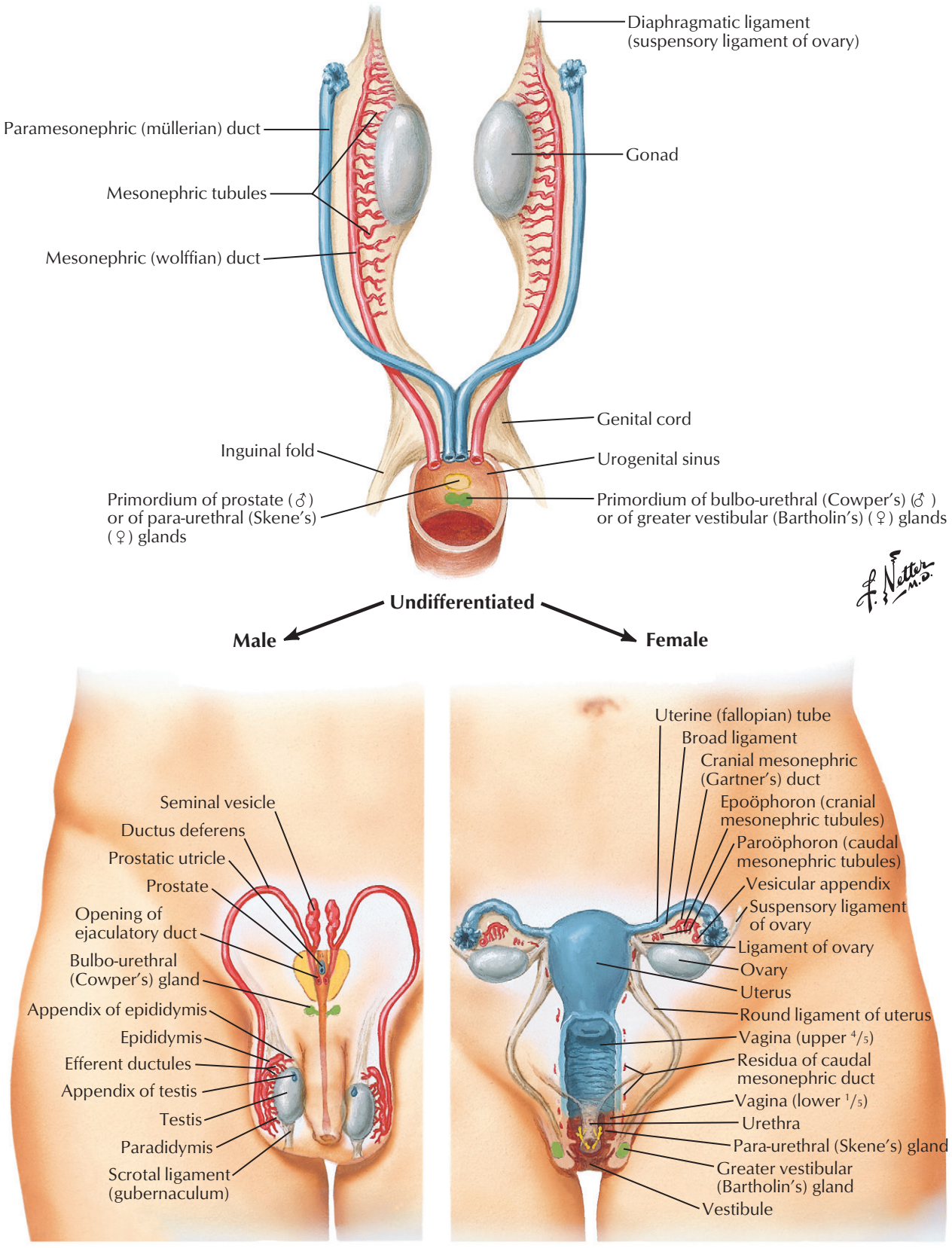
8 lunar months
(26-cm crown–rump)

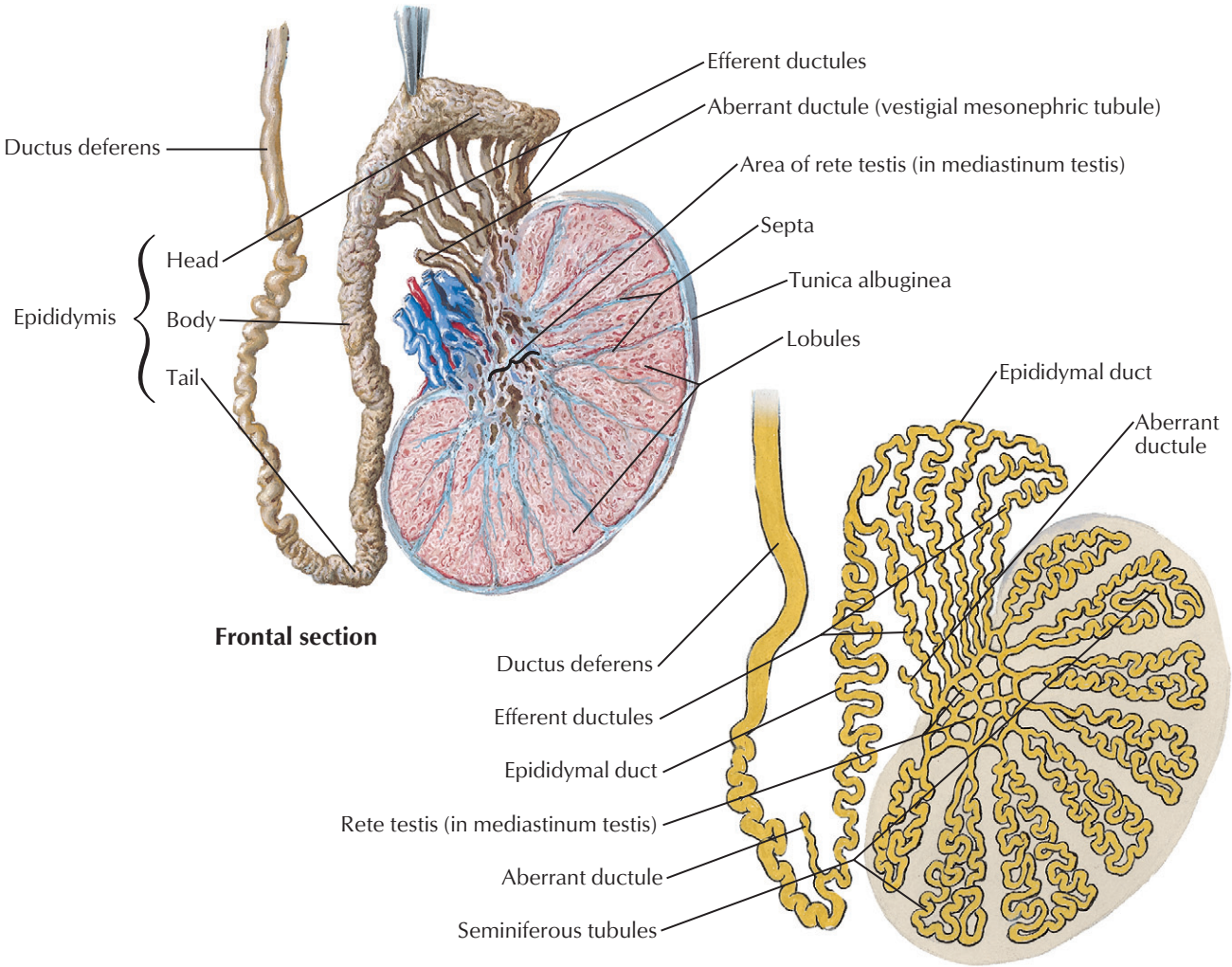

Skin of penis
Superficial fascia (dartos) of penis
Deep (Buck's) fascia of penis
Testicular artery
Ductus deferens
Artery to ductus deferens
Genital branch of genitofemoral nerve
Pampiniform (venous) plexus
Epididymis (head)
Appendix of epididymis
Appendix of testis
Testis (covered by visceral layer of tunica vaginalis)
Parietal layer of tunica vaginalis
Superficial inguinal ring
External spermatic fascia
Cremaster muscle and fascia
Septum of scrotum (formed by dartos fascia)
Superficial (dartos) fascia of scrotum
Skin of scrotum


Superficial (dartos) fascia of scrotum
External spermatic fascia
Cremaster muscle and fascia
Internal spermatic fascia
Parietal layer of tunica vaginalis
Epididymis (body)
Testis (covered by visceral layer of tunica vaginalis)
Skin of scrotum

See also Plate 354

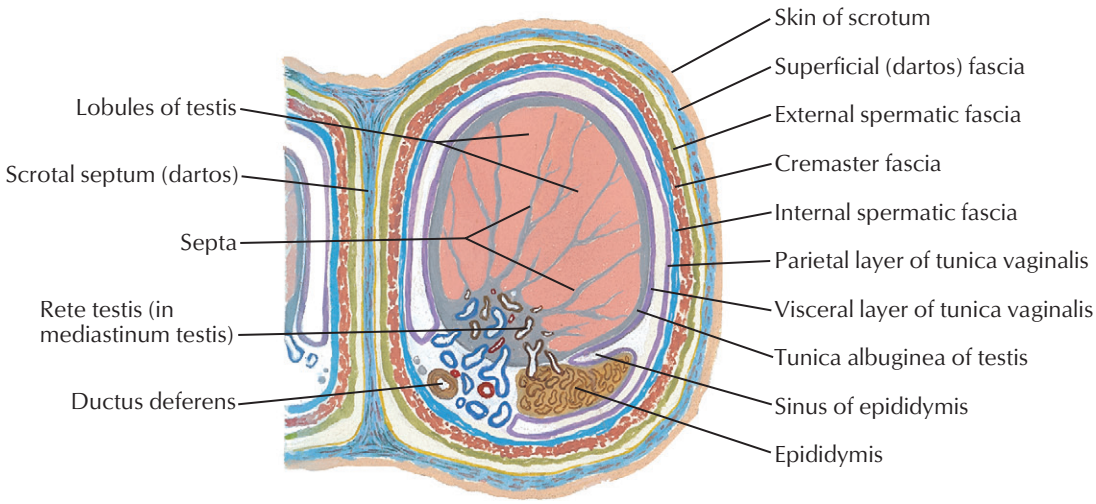



Diaphragmatic ligament
(suspensory ligament of ovary)
Paramesonephric (müllerian) duct
Gonad
Mesonephric tubules
Mesonephric (wolffian) duct
Genital cord
Inguinal fold
Urogenital sinus
Primordium of prostate (♂)
or of para-urethral (Skene's)
(♀) glands
Primordium of bulbo-urethral (Cowper's) (♂)
or of greater vestibular (Bartholin's) (♀) glands
F. Netter M.D.
Undifferentiated
Male
Female
Seminal vesicle
Ductus deferens
Prostatic utricle
Prostate
Opening of
ejaculatory duct
Bulbo-urethral
(Cowper's) gland
Appendix of epididymis
Epididymis
Efferent ductules
Appendix of testis
Testis
Paradidymis
Scrotal ligament
(gubernaculum)
Uterine (fallopian) tube
Broad ligament
Cranial mesonephric
(Gartner's) duct
Epoöphoron (cranial
mesonephric tubules)
Paroöphoron (caudal
mesonephric tubules)
Vesicular appendix
Suspensory ligament
of ovary
Ligament of ovary
Ovary
Uterus
Round ligament of uterus
Vagina (upper 4/5)
Residua of caudal
mesonephric duct
Vagina (lower 1/5)
Urethra
Para-urethral (Skene's) gland
Greater vestibular
(Bartholin's) gland
Vestibule

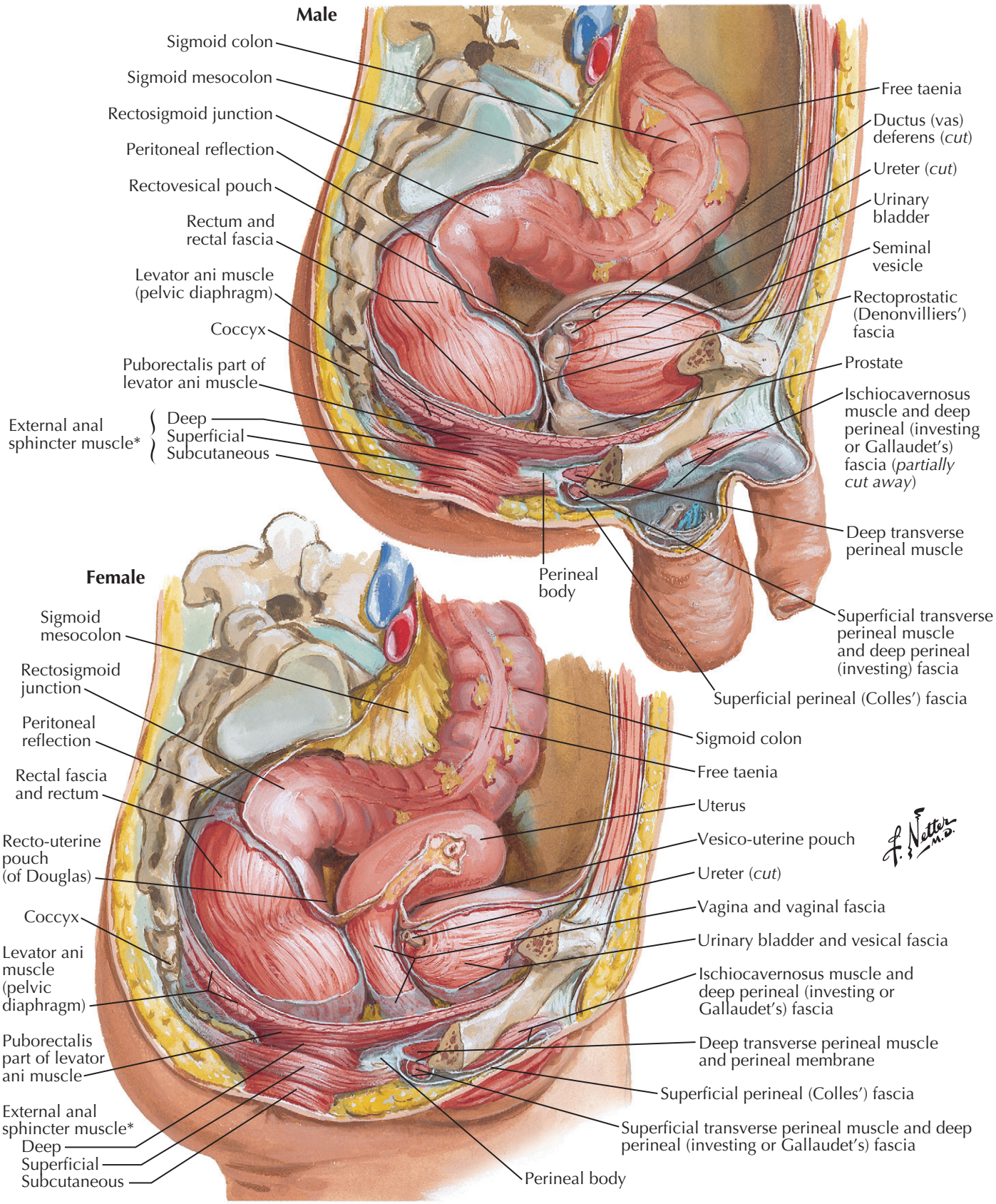


Frontal section

Schema



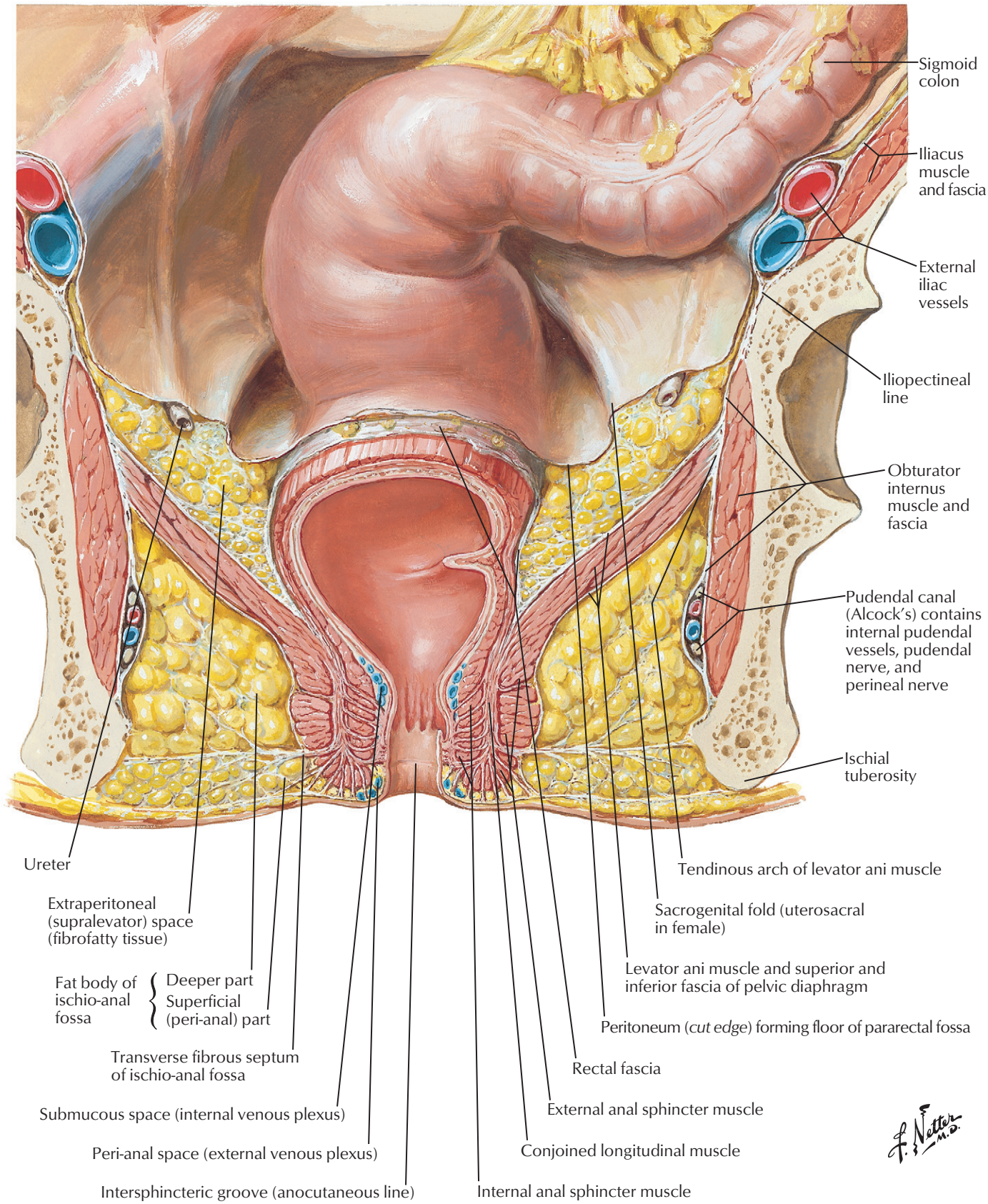
Cross section through scrotum and testis

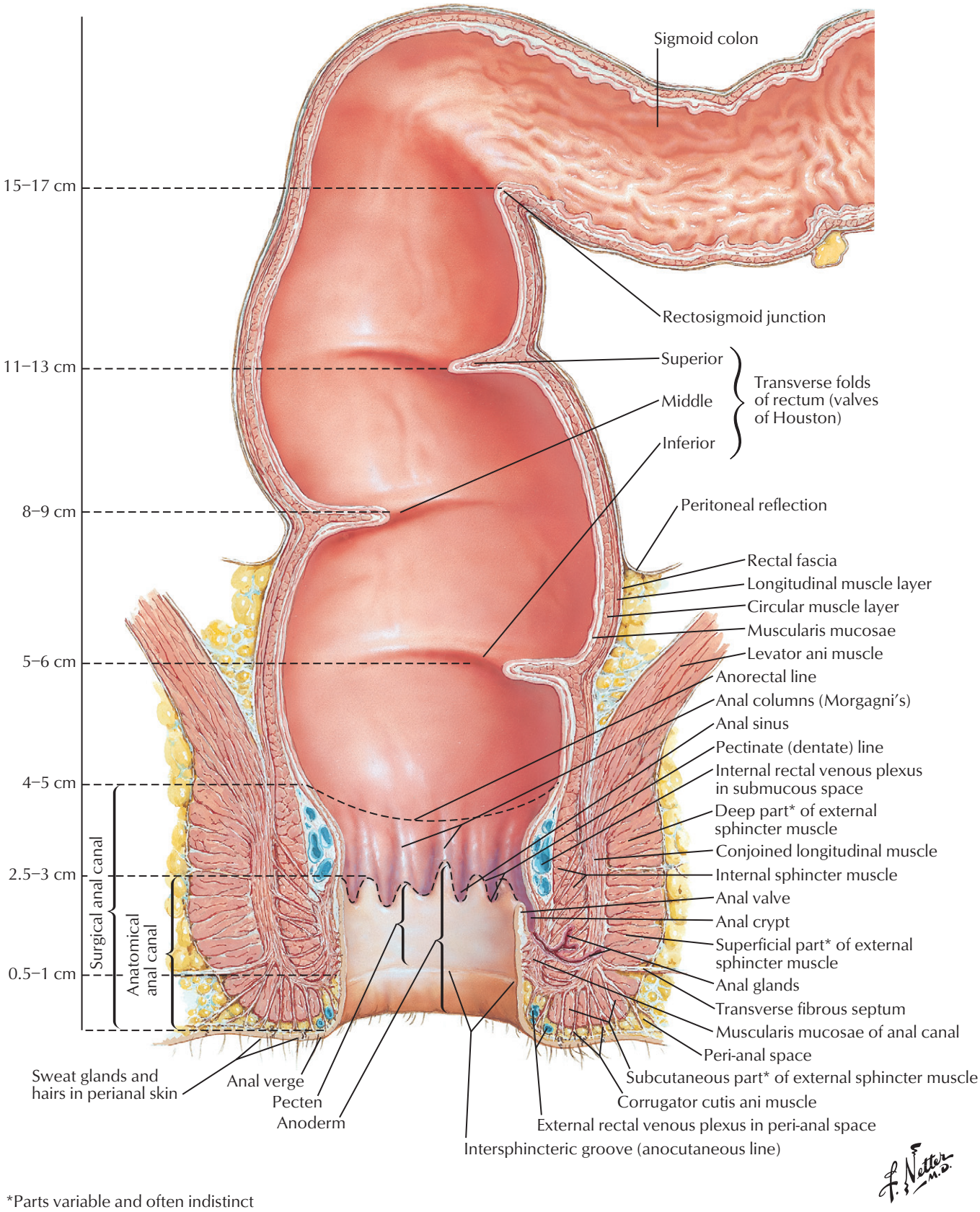


*Parts variable and often indistinct

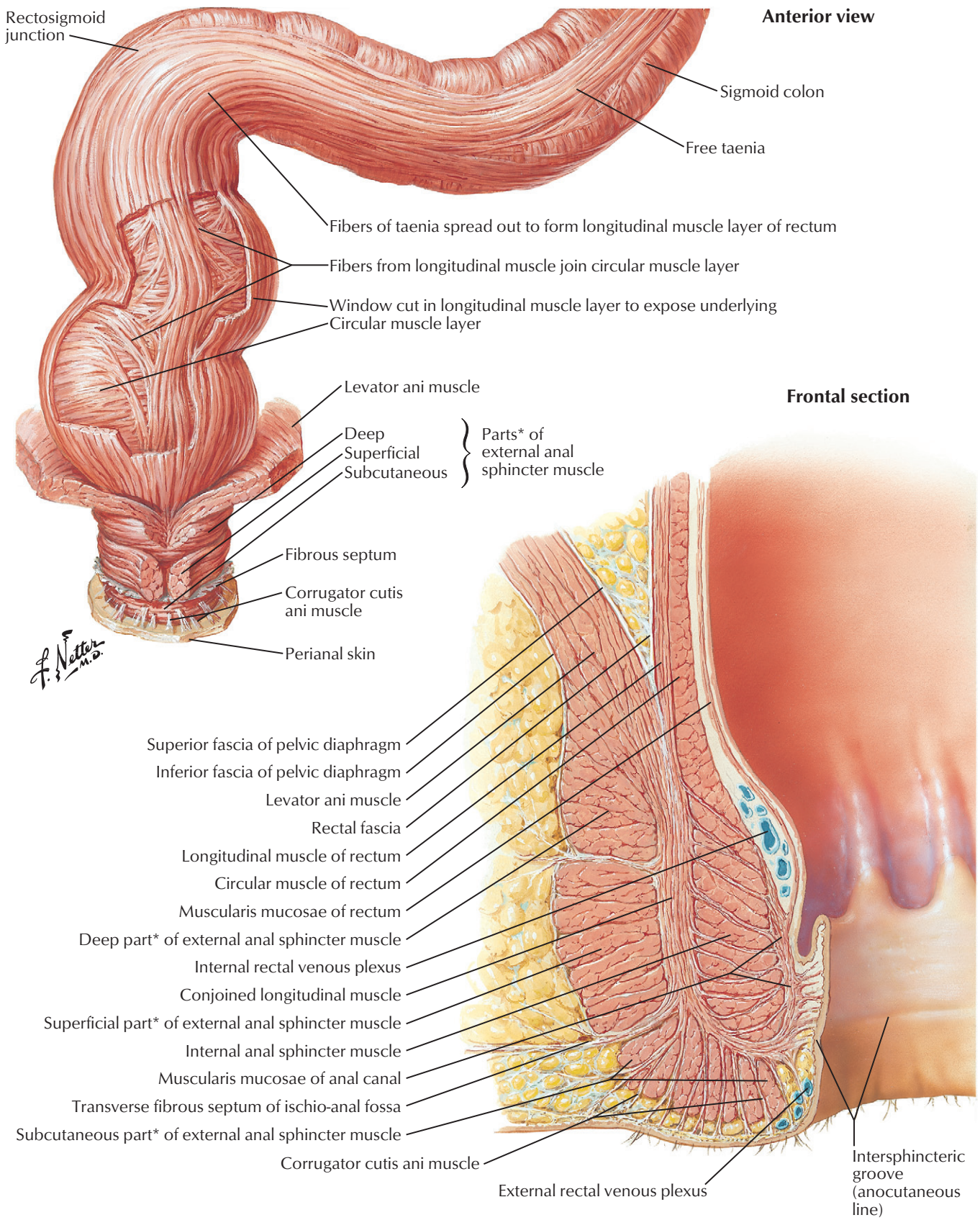
Ischio-anal Fossae

See also **Plates 296**, **388**





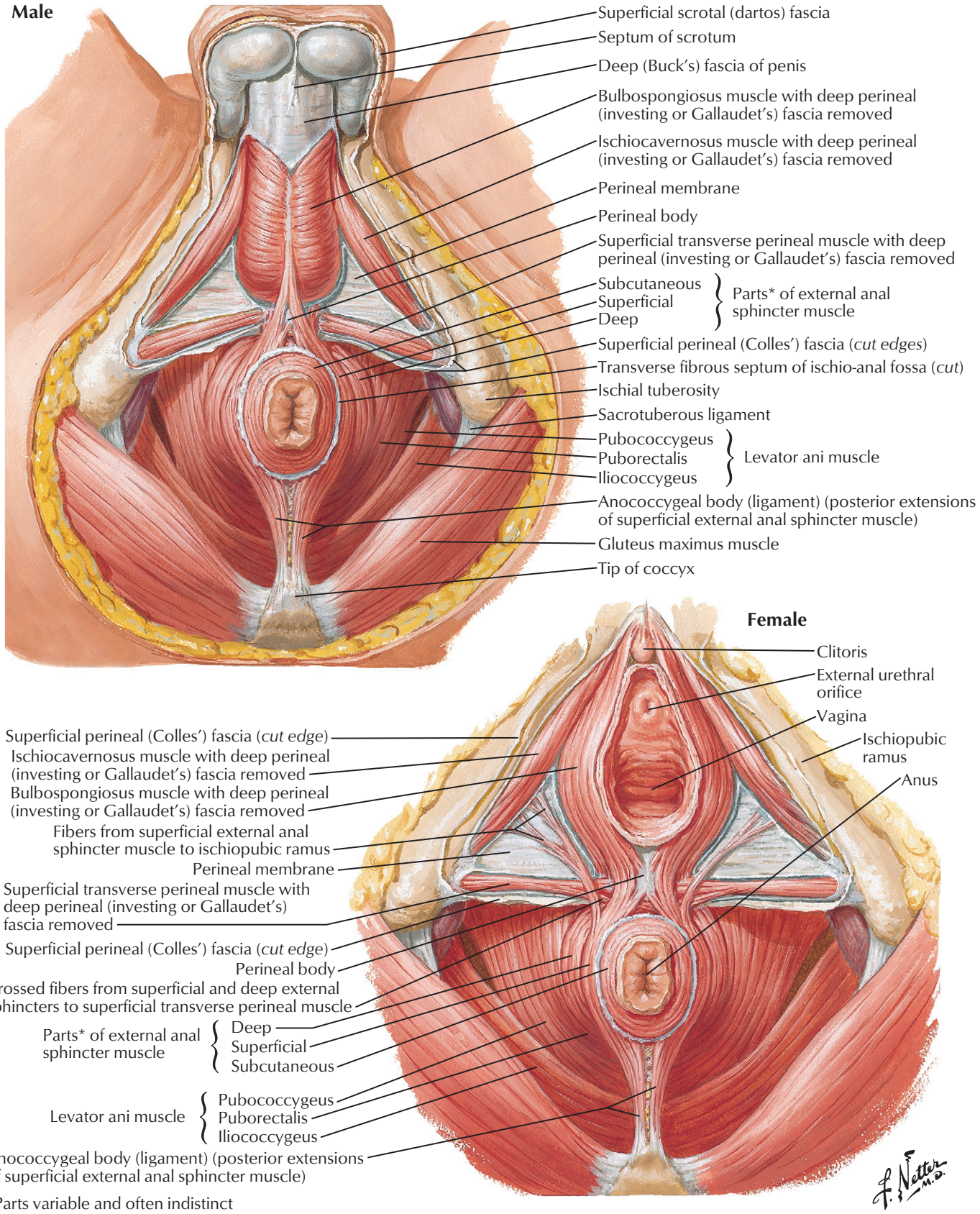
*Parts variable and often indistinct



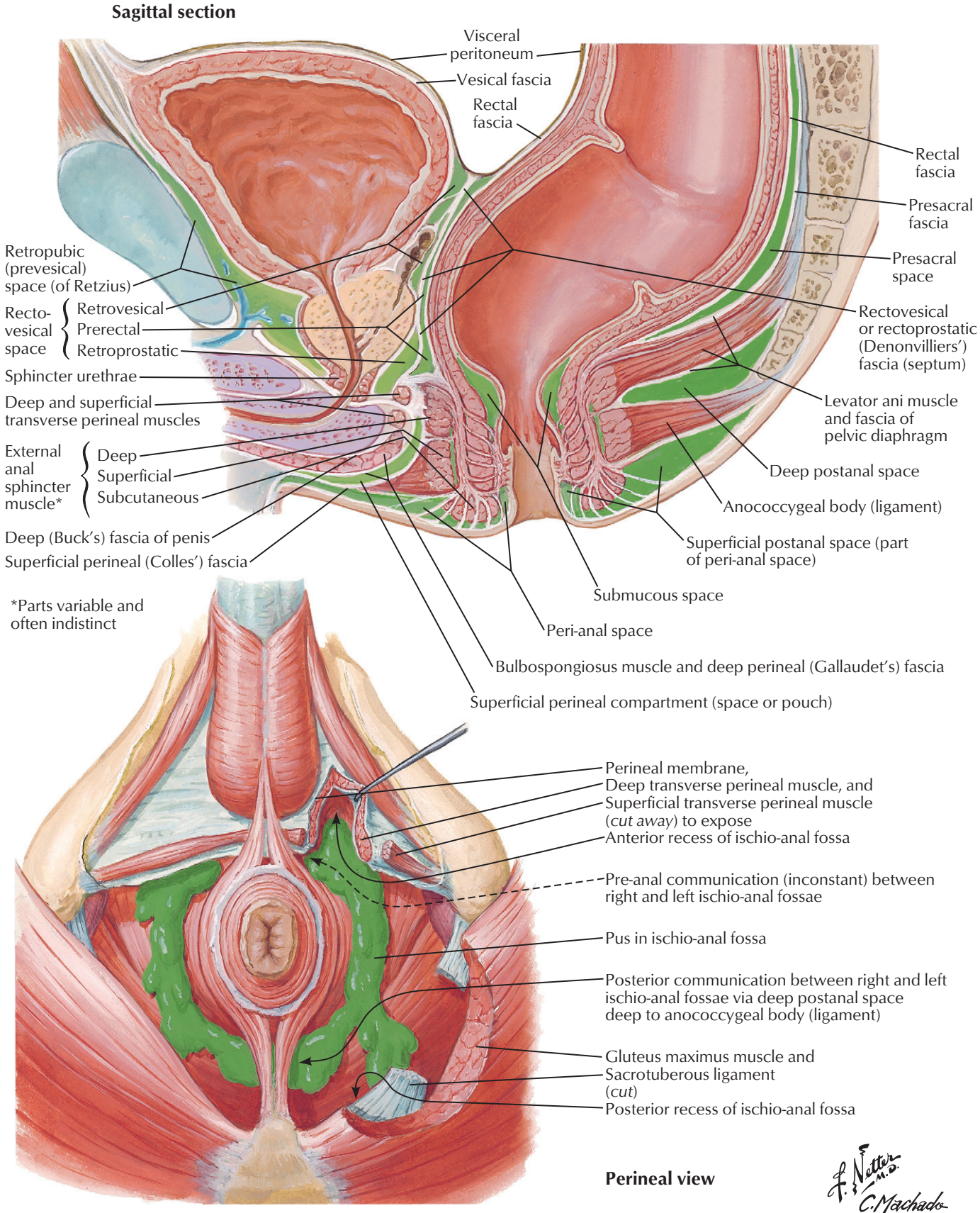
*Parts variable and often indistinct

External Anal Sphincter Muscle: Perineal Views

See also Plates 356, 359



*Parts variable and often indistinct



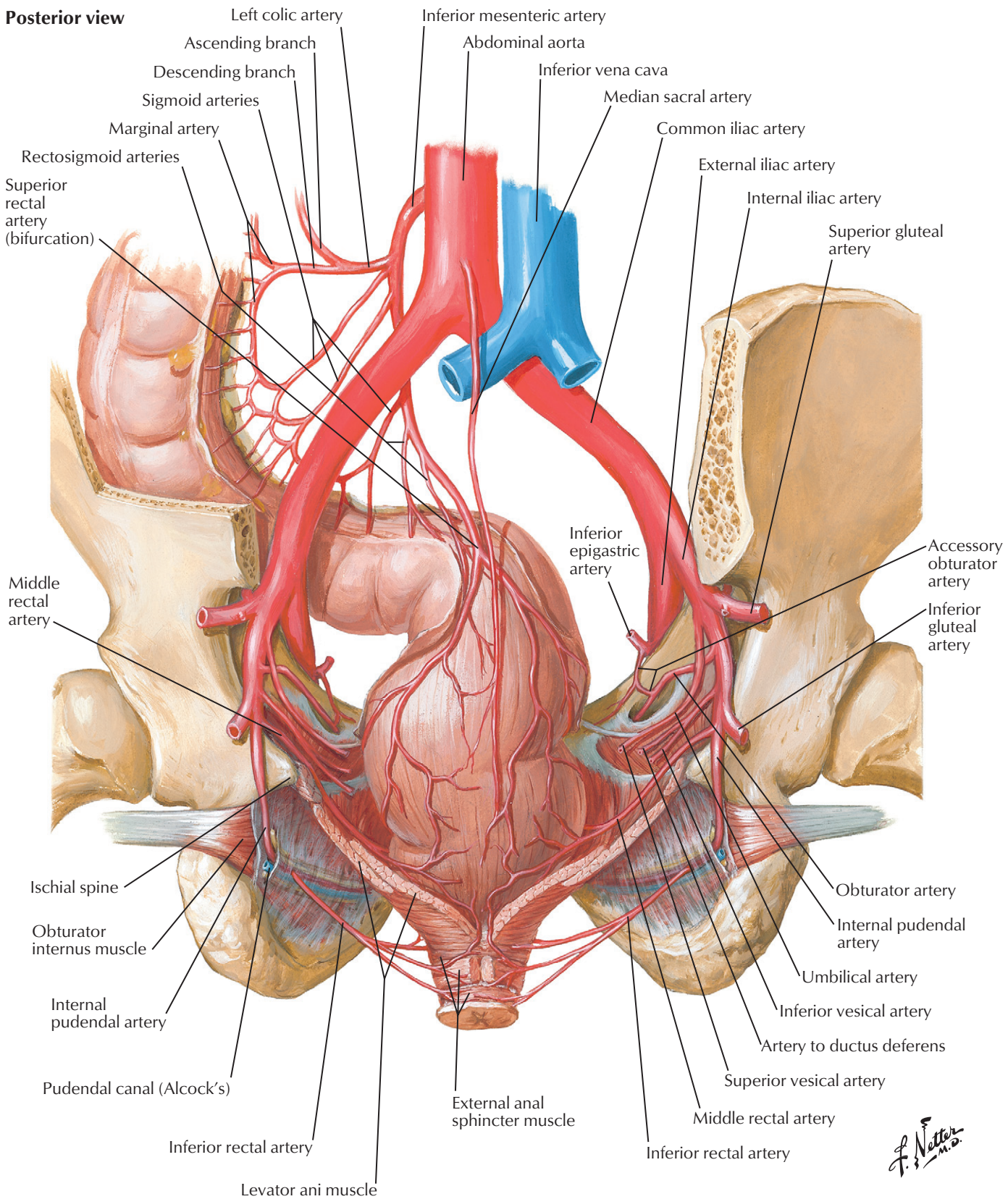
Spread of perineal abscess in perineal spaces

Female

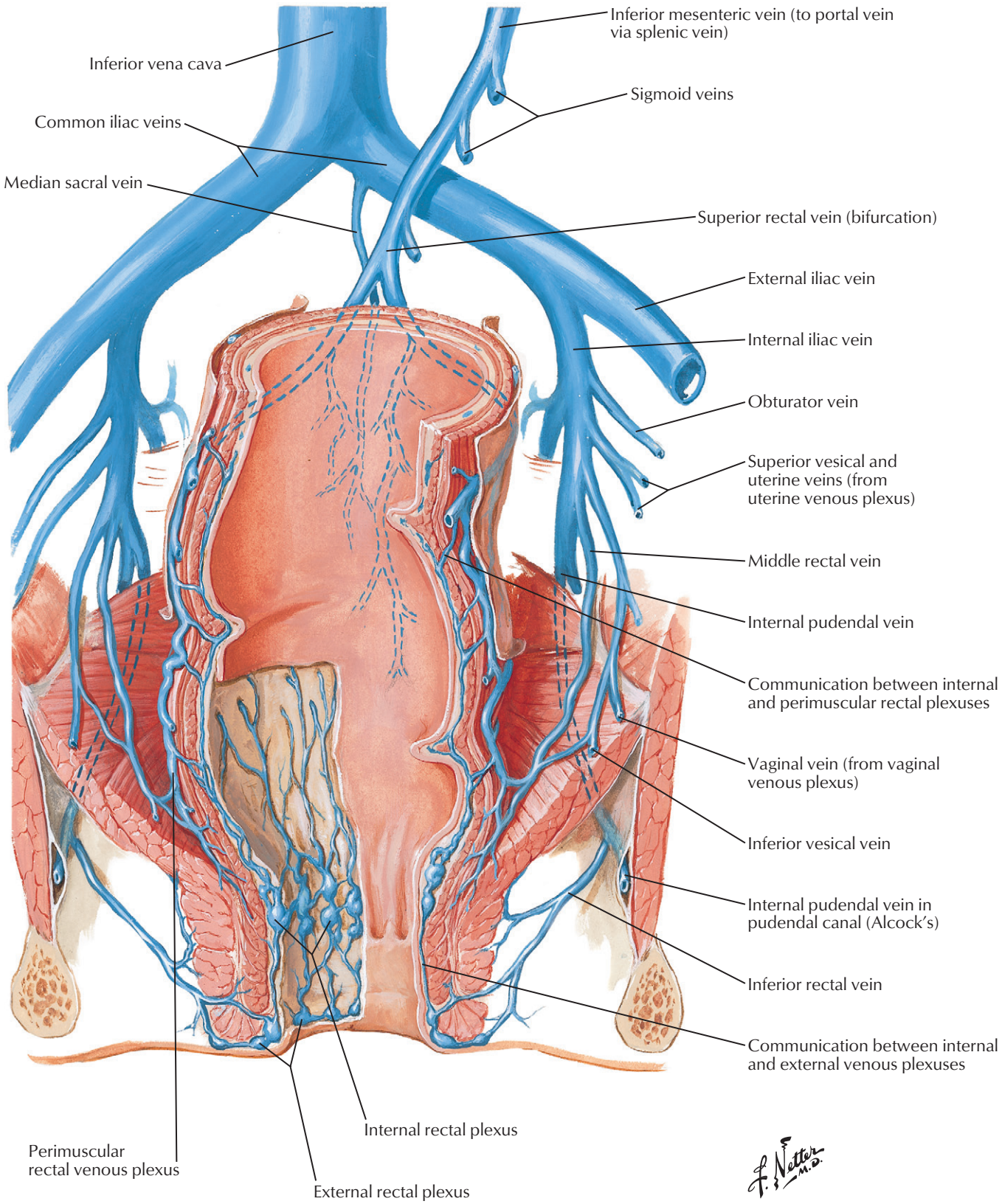

Umbilicus
Rectus abdominis muscle
Fundus of uterus
Urinary bladder
Pubic bone
L5 vertebra
Sacrum
Rectum
Vagina

Male

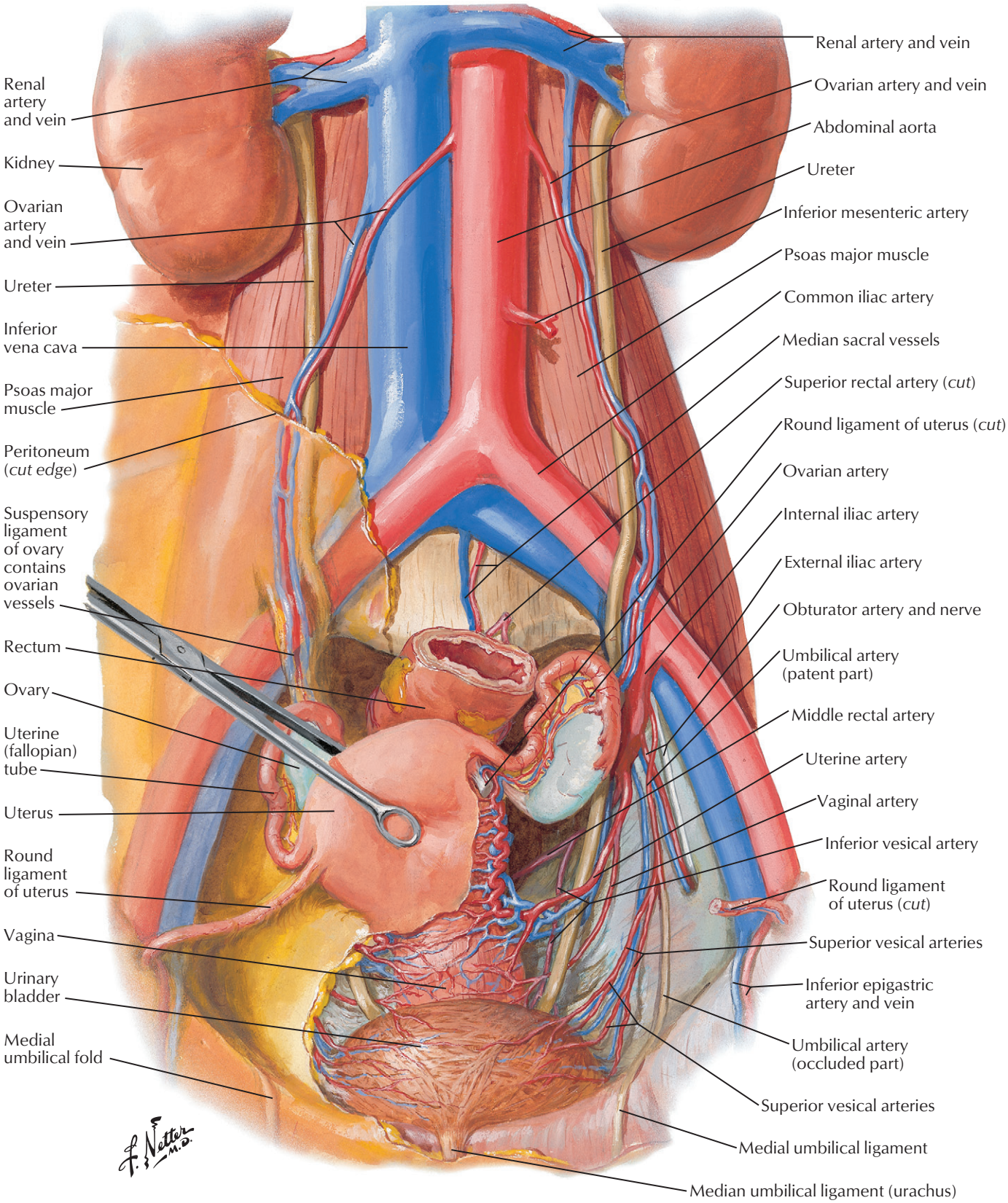

Liver
Rectus abdominis muscle
Pubic bone
Penis
Scrotum
Urinary bladder
Rectum

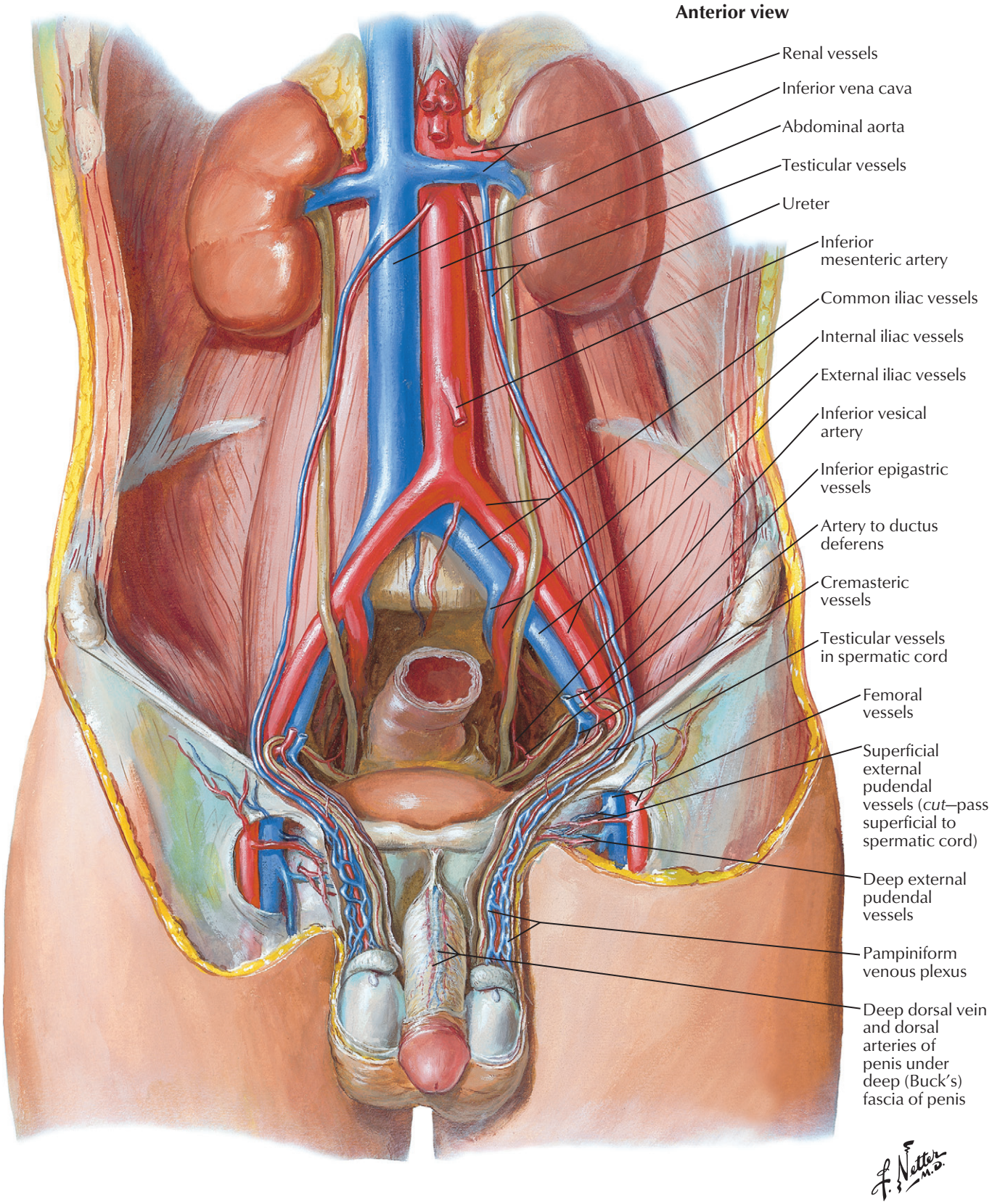

Posterior view
Left colic artery
Ascending branch
Descending branch
Sigmoid arteries
Marginal artery
Rectosigmoid arteries
Superior rectal artery (bifurcation)
Inferior mesenteric artery
Abdominal aorta
Inferior vena cava
Median sacral artery
Common iliac artery
External iliac artery
Internal iliac artery
Superior gluteal artery
Inferior epigastric artery
Accessory obturator artery
Inferior gluteal artery
Middle rectal artery
Ischial spine
Obturator internus muscle
Internal pudendal artery
Pudendal canal (Alcock's)
Inferior rectal artery
Levator ani muscle
External anal sphincter muscle
Middle rectal artery
Inferior rectal artery
Obturator artery
Internal pudendal artery
Umbilical artery
Inferior vesical artery
Artery to ductus deferens
Superior vesical artery

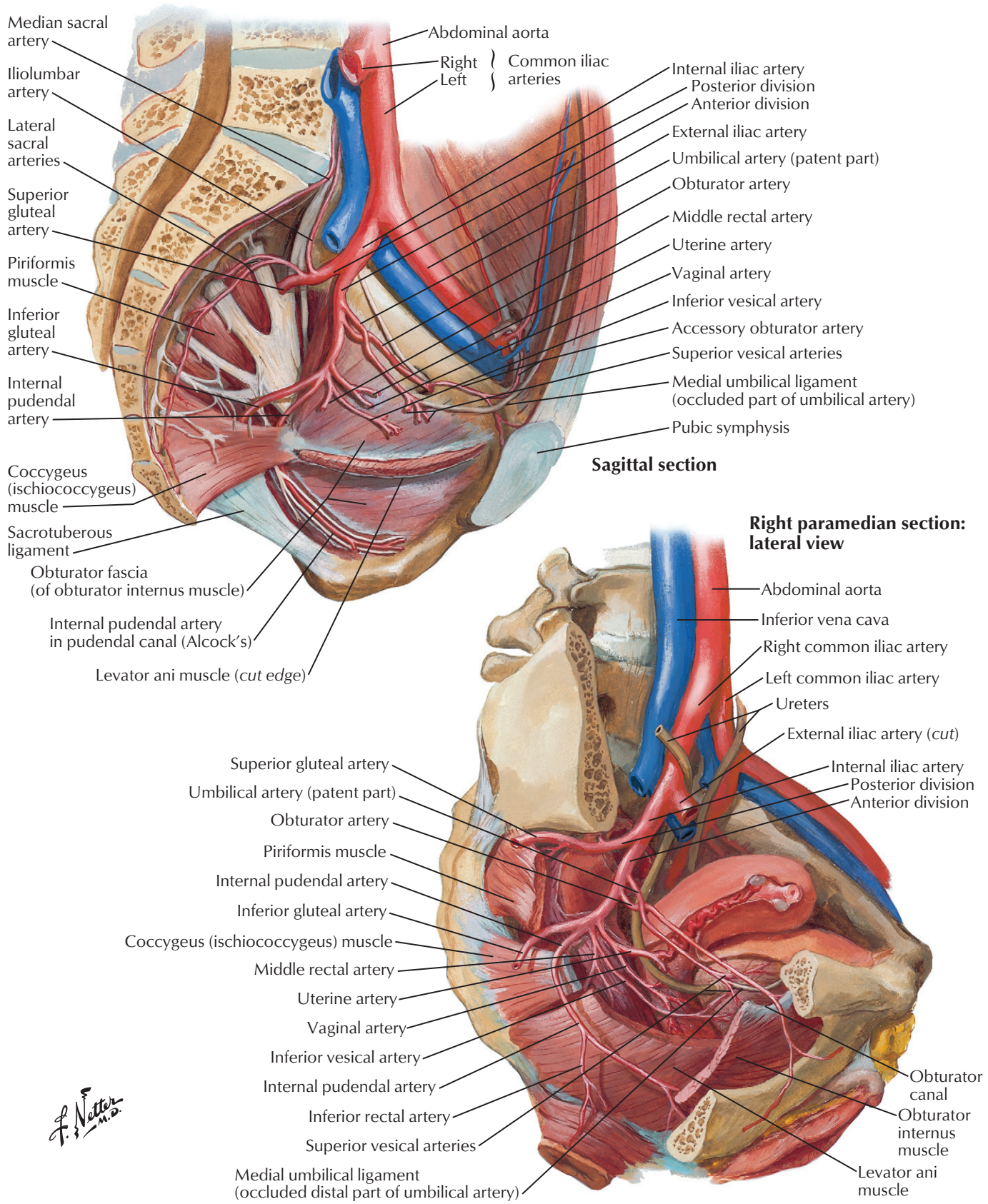
Anterior view



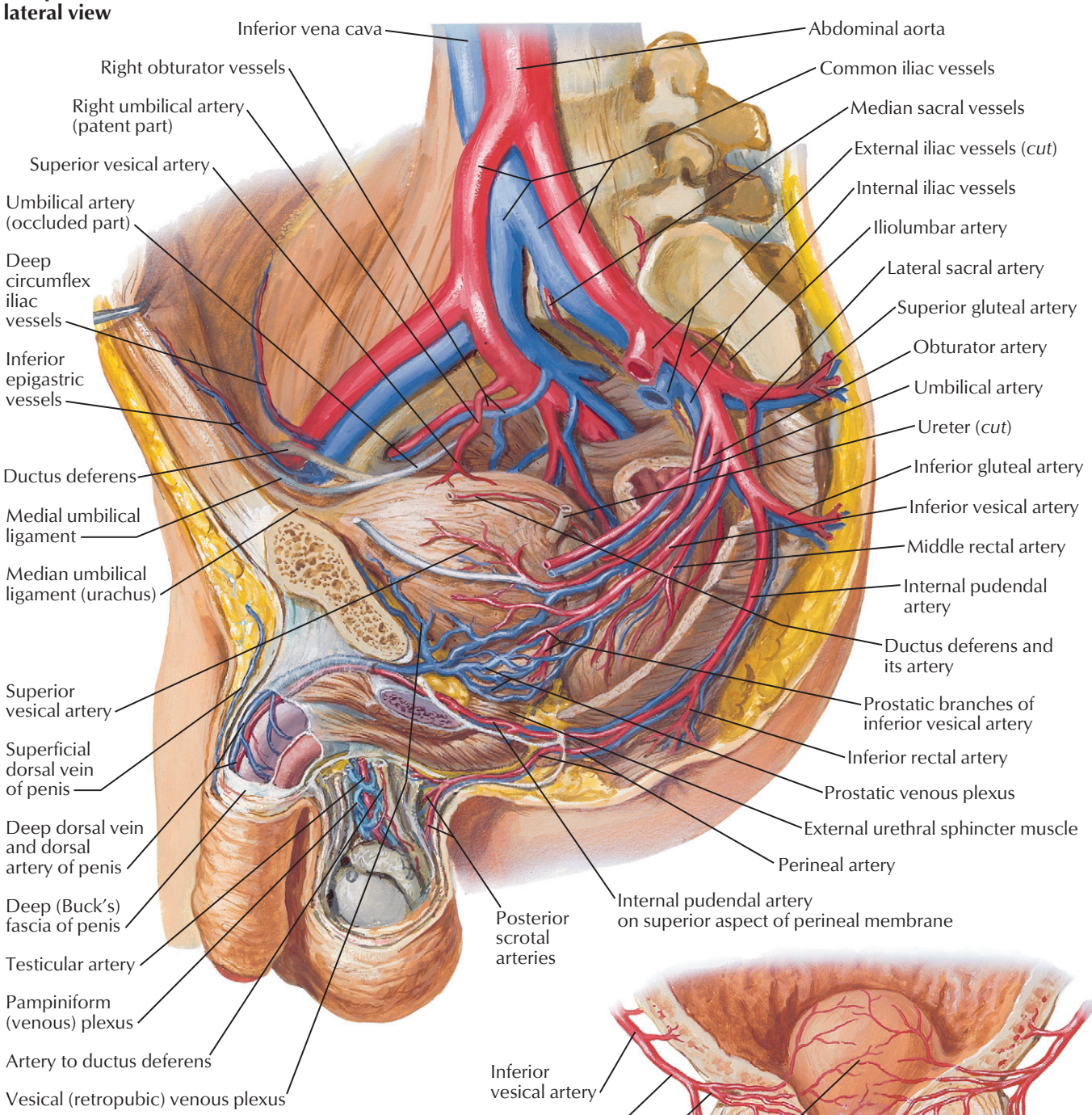
Anterior view

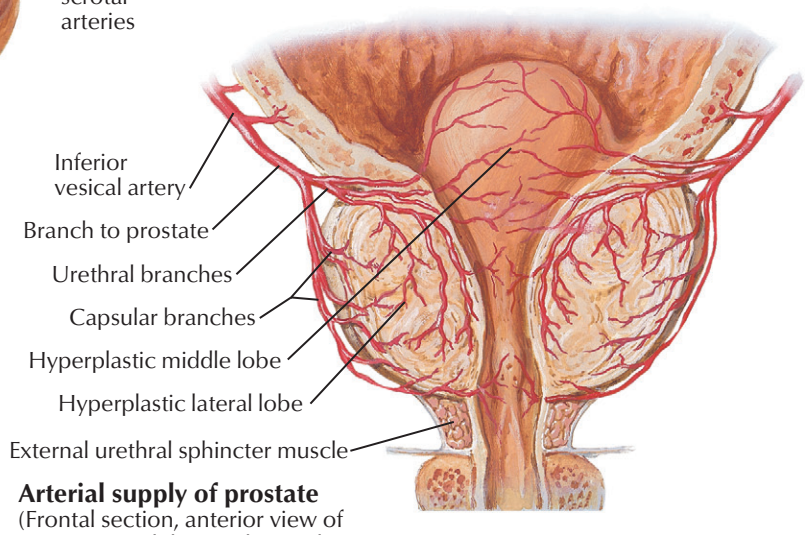



Anterior view
Renal vessels
Inferior vena cava
Abdominal aorta
Testicular vessels
Ureter
Inferior mesenteric artery
Common iliac vessels
Internal iliac vessels
External iliac vessels
Inferior vesical artery
Inferior epigastric vessels
Artery to ductus deferens
Cremasteric vessels
Testicular vessels in spermatic cord
Femoral vessels
Superficial external pudendal vessels (*cut*—pass superficial to spermatic cord)
Deep external pudendal vessels
Pampiniform venous plexus
Deep dorsal vein and dorsal arteries of penis under deep (Buck's) fascia of penis
F. Netter M.D.


Median sacral artery
Iliolumbar artery
Lateral sacral arteries
Superior gluteal artery
Piriformis muscle
Inferior gluteal artery
Internal pudendal artery
Coccygeus (ischiococcygeus) muscle
Sacrotuberous ligament
Obturator fascia (of obturator internus muscle)
Internal pudendal artery in pudendal canal (Alcock's)
Levator ani muscle (cut edge)
Abdominal aorta
Right
Left
Common iliac arteries
Internal iliac artery
Posterior division
Anterior division
External iliac artery
Umbilical artery (patent part)
Obturator artery
Middle rectal artery
Uterine artery
Vaginal artery
Inferior vesical artery
Accessory obturator artery
Superior vesical arteries
Medial umbilical ligament (occluded part of umbilical artery)
Pubic symphysis
Sagittal section
Right paramedian section: lateral view
Abdominal aorta
Inferior vena cava
Right common iliac artery
Left common iliac artery
Ureters
External iliac artery (cut)
Internal iliac artery
Posterior division
Anterior division
Superior gluteal artery
Umbilical artery (patent part)
Obturator artery
Piriformis muscle
Internal pudendal artery
Inferior gluteal artery
Coccygeus (ischiococcygeus) muscle
Middle rectal artery
Uterine artery
Vaginal artery
Inferior vesical artery
Internal pudendal artery
Inferior rectal artery
Superior vesical arteries
Medial umbilical ligament (occluded distal part of umbilical artery)
Obturator canal
Obturator internus muscle
Levator ani muscle

Left paramedian section: lateral view

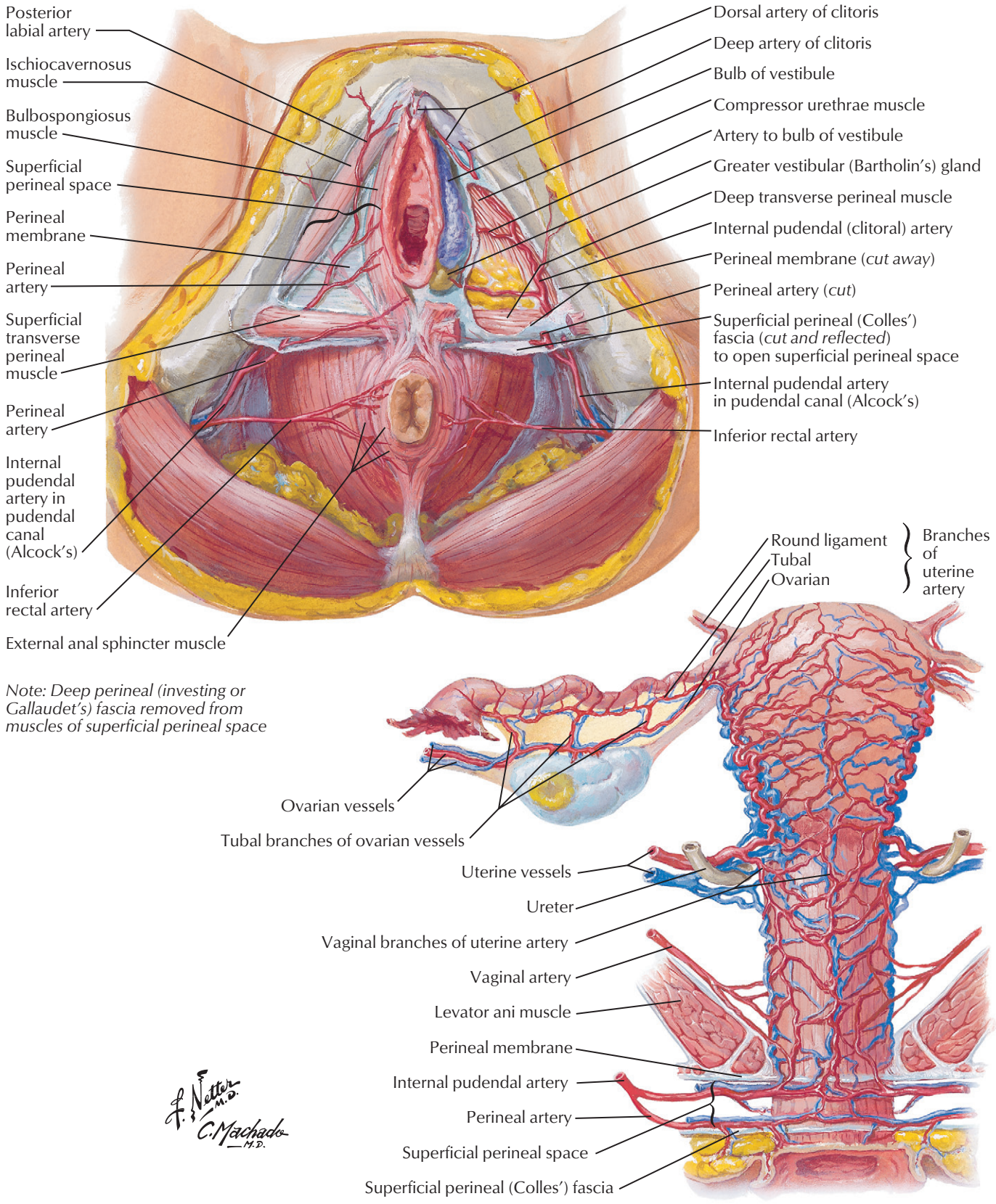




Arterial supply of prostate
(Frontal section, anterior view of specimen with benign hyperplasia)

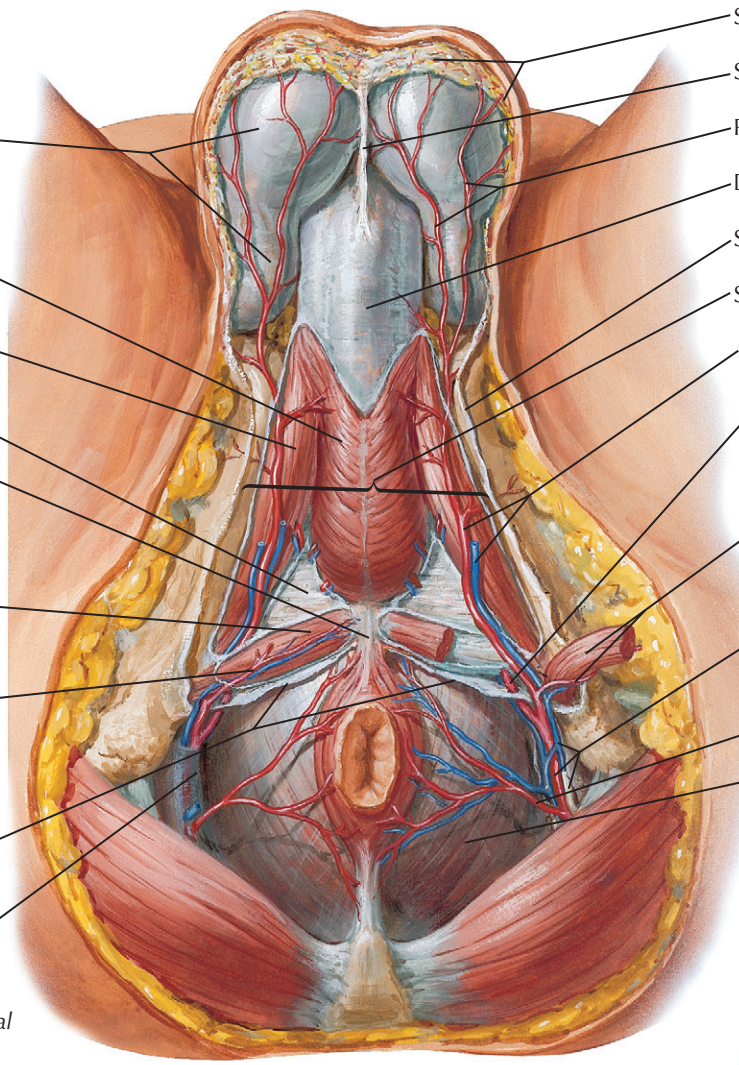
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Arteries and Veins of Perineum and Uterus

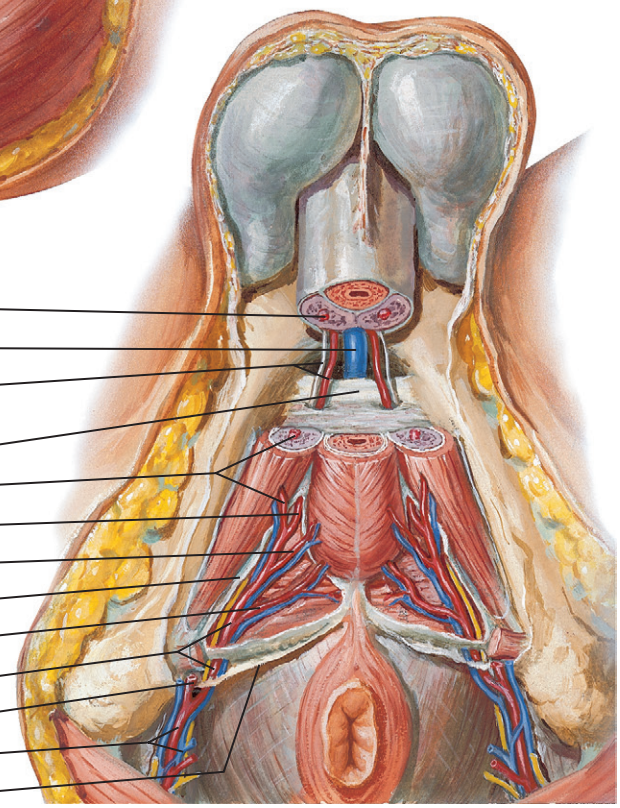


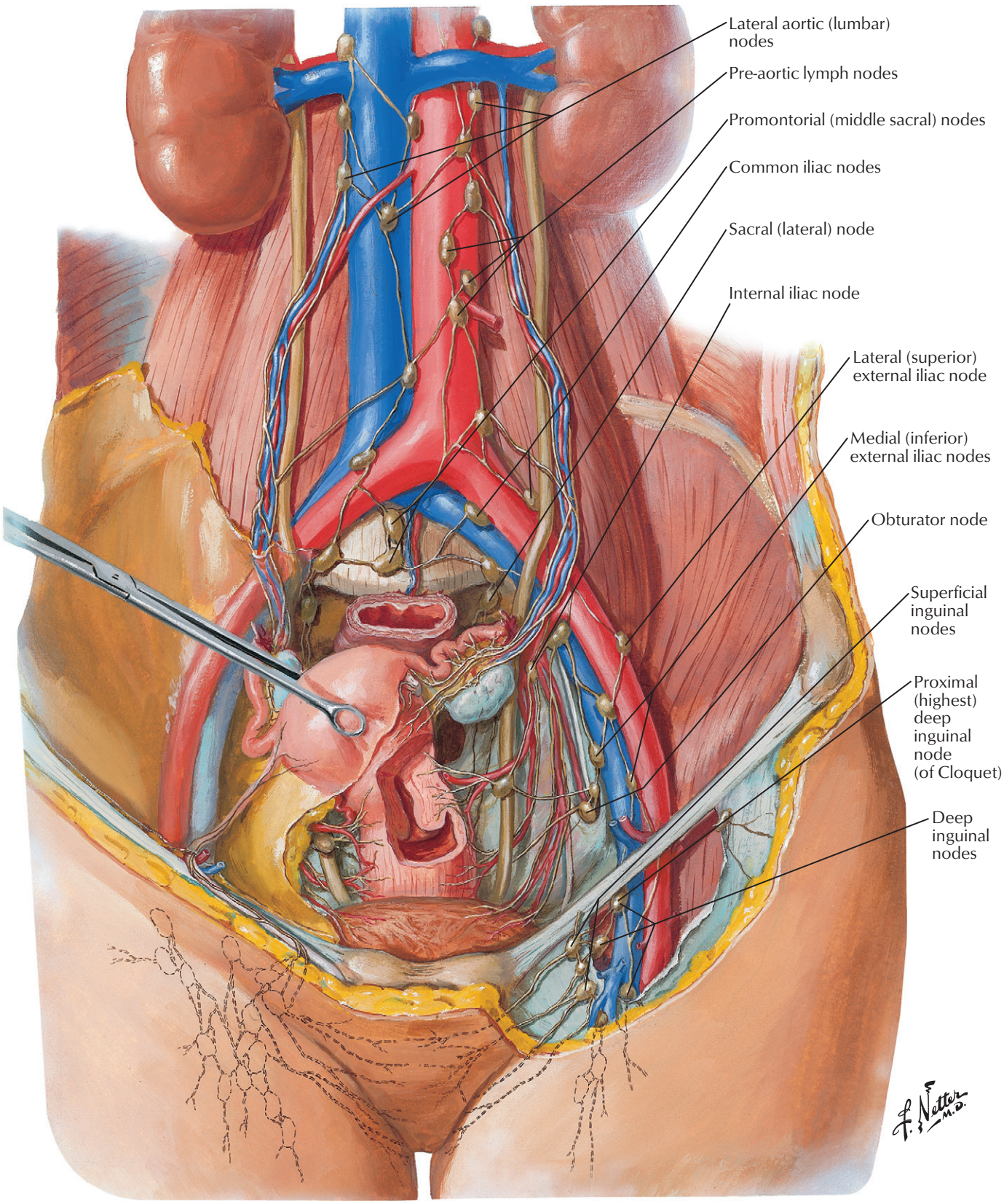
Note: Deep perineal (investing or Gallaudet's) fascia removed from muscles of superficial perineal space

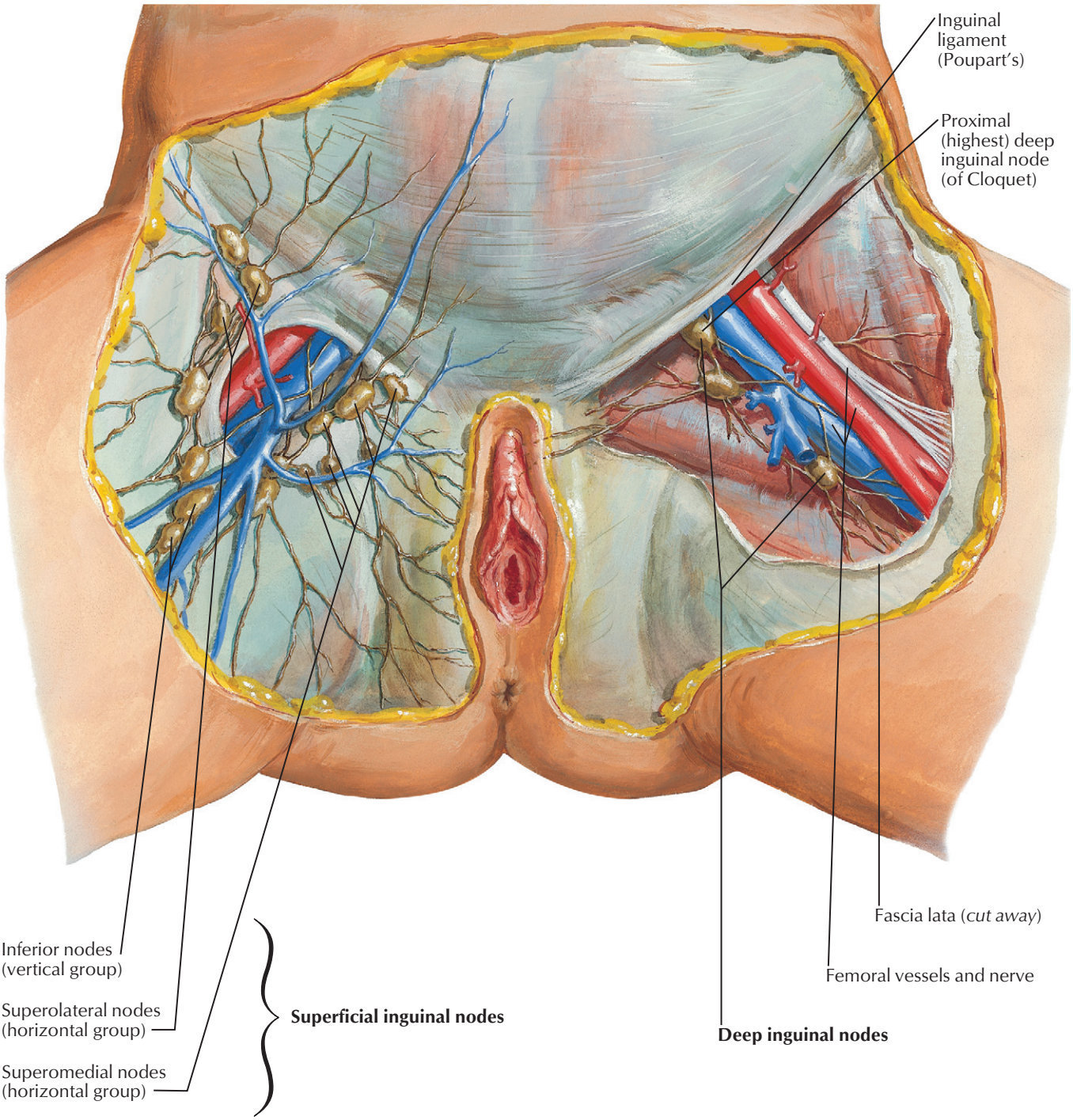
F. Netter M.D. C. Machado M.D.

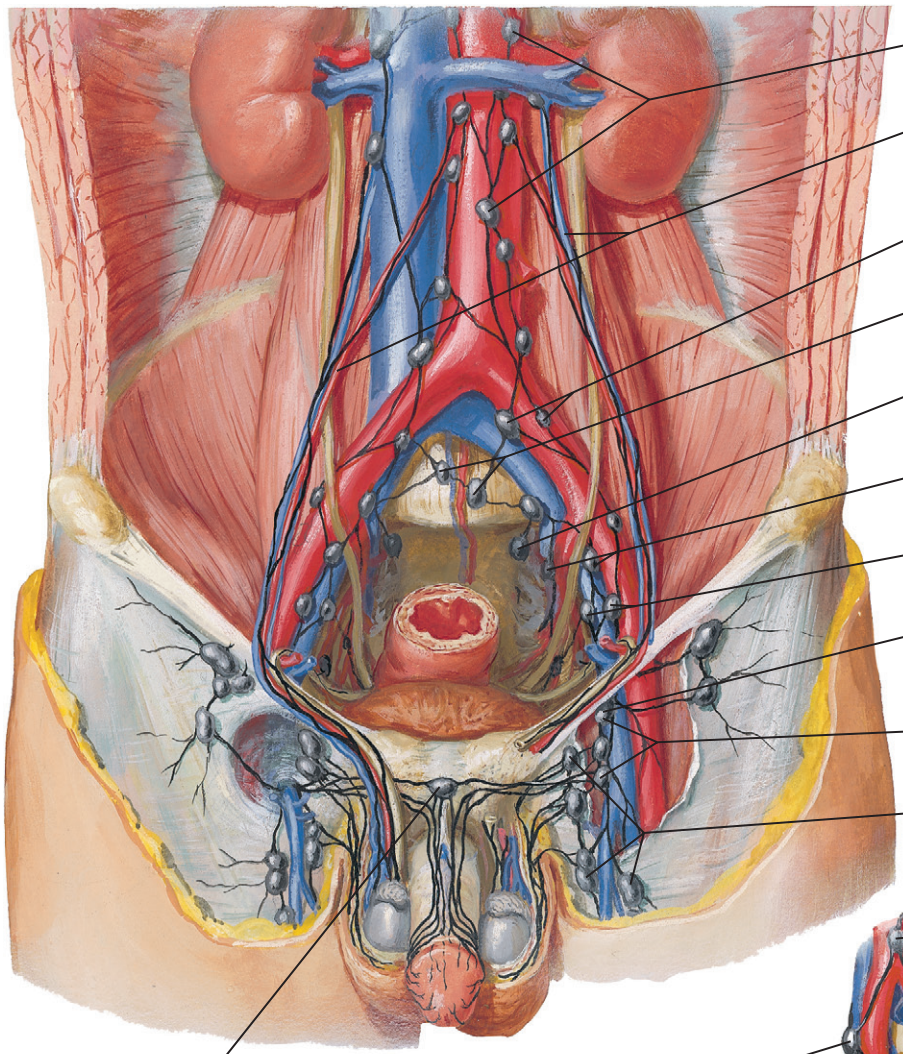


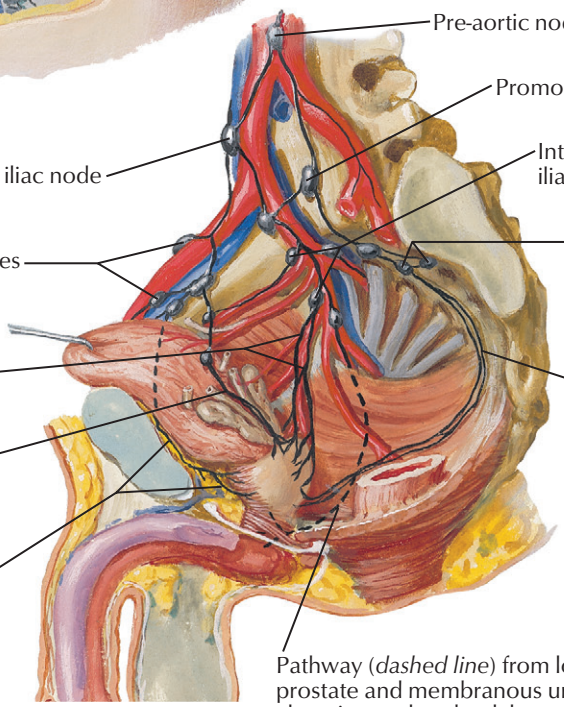
Note: Deep perineal (investing or Gallaudet's) fascia removed from muscles of superficial perineal space



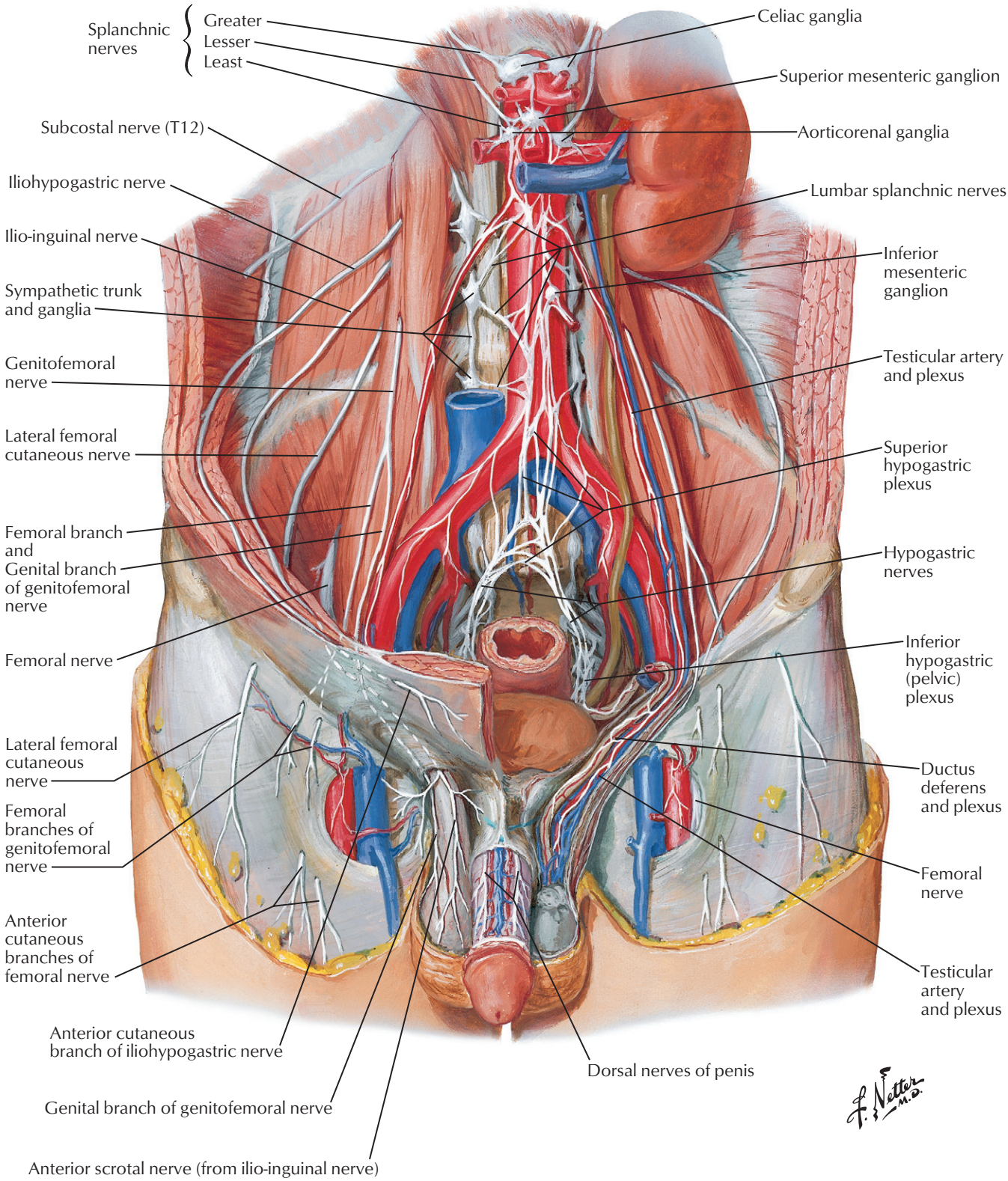

Lateral aortic (lumbar) nodes
Pre-aortic lymph nodes
Promontorial (middle sacral) nodes
Common iliac nodes
Sacral (lateral) node
Internal iliac node
Lateral (superior) external iliac node
Medial (inferior) external iliac nodes
Obturator node
Superficial inguinal nodes
Proximal (highest) deep inguinal node (of Cloquet)
Deep inguinal nodes


Inguinal ligament (Poupart's)
Proximal (highest) deep inguinal node (of Cloquet)
Fascia lata (*cut away*)
Femoral vessels and nerve
Inferior nodes (vertical group)
Superolateral nodes (horizontal group)
Superomedial nodes (horizontal group)
Superficial inguinal nodes
Deep inguinal nodes



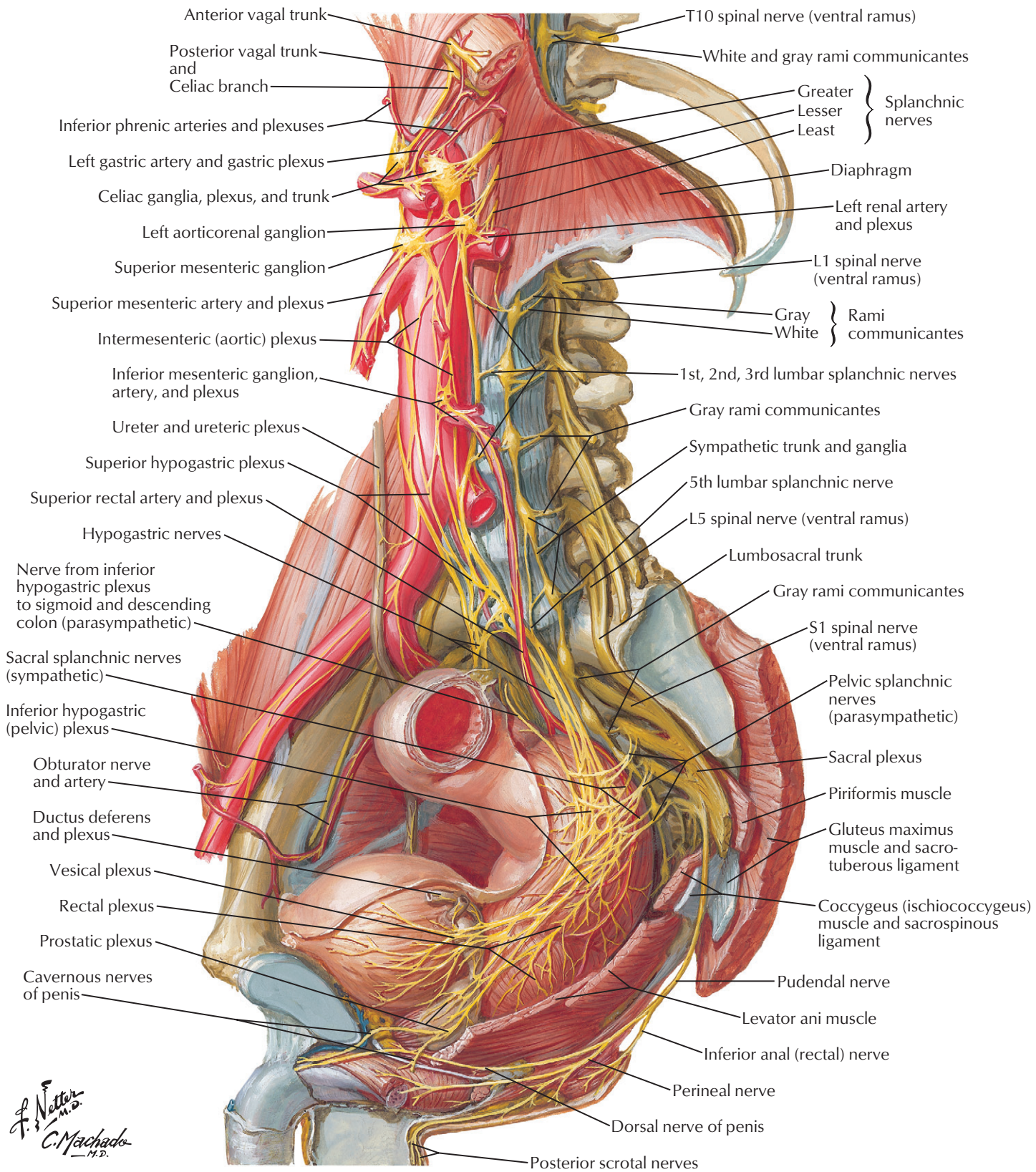


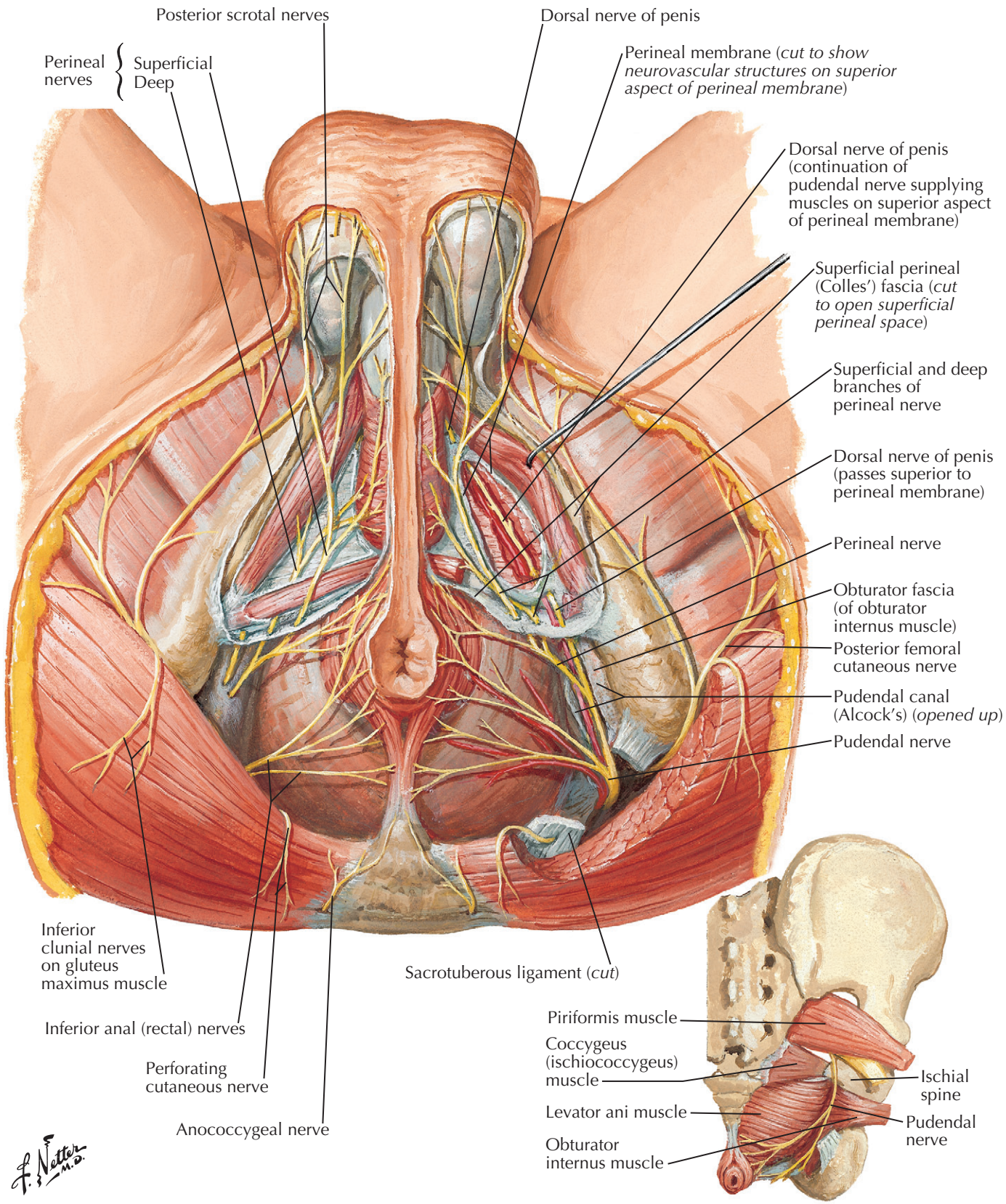
Lymphatic drainage from prostate


Splanchnic nerves
Greater
Lesser
Least
Subcostal nerve (T12)
Iliohypogastric nerve
Ilio-inguinal nerve
Sympathetic trunk and ganglia
Genitofemoral nerve
Lateral femoral cutaneous nerve
Femoral branch and Genital branch of genitofemoral nerve
Femoral nerve
Lateral femoral cutaneous nerve
Femoral branches of genitofemoral nerve
Anterior cutaneous branches of femoral nerve
Anterior cutaneous branch of iliohypogastric nerve
Genital branch of genitofemoral nerve
Anterior scrotal nerve (from ilio-inguinal nerve)
Celiac ganglia
Superior mesenteric ganglion
Aorticorenal ganglia
Lumbar splanchnic nerves
Inferior mesenteric ganglion
Testicular artery and plexus
Superior hypogastric plexus
Hypogastric nerves
Inferior hypogastric (pelvic) plexus
Ductus deferens and plexus
Femoral nerve
Testicular artery and plexus
Dorsal nerves of penis

Nerves of Pelvic Viscera: Male

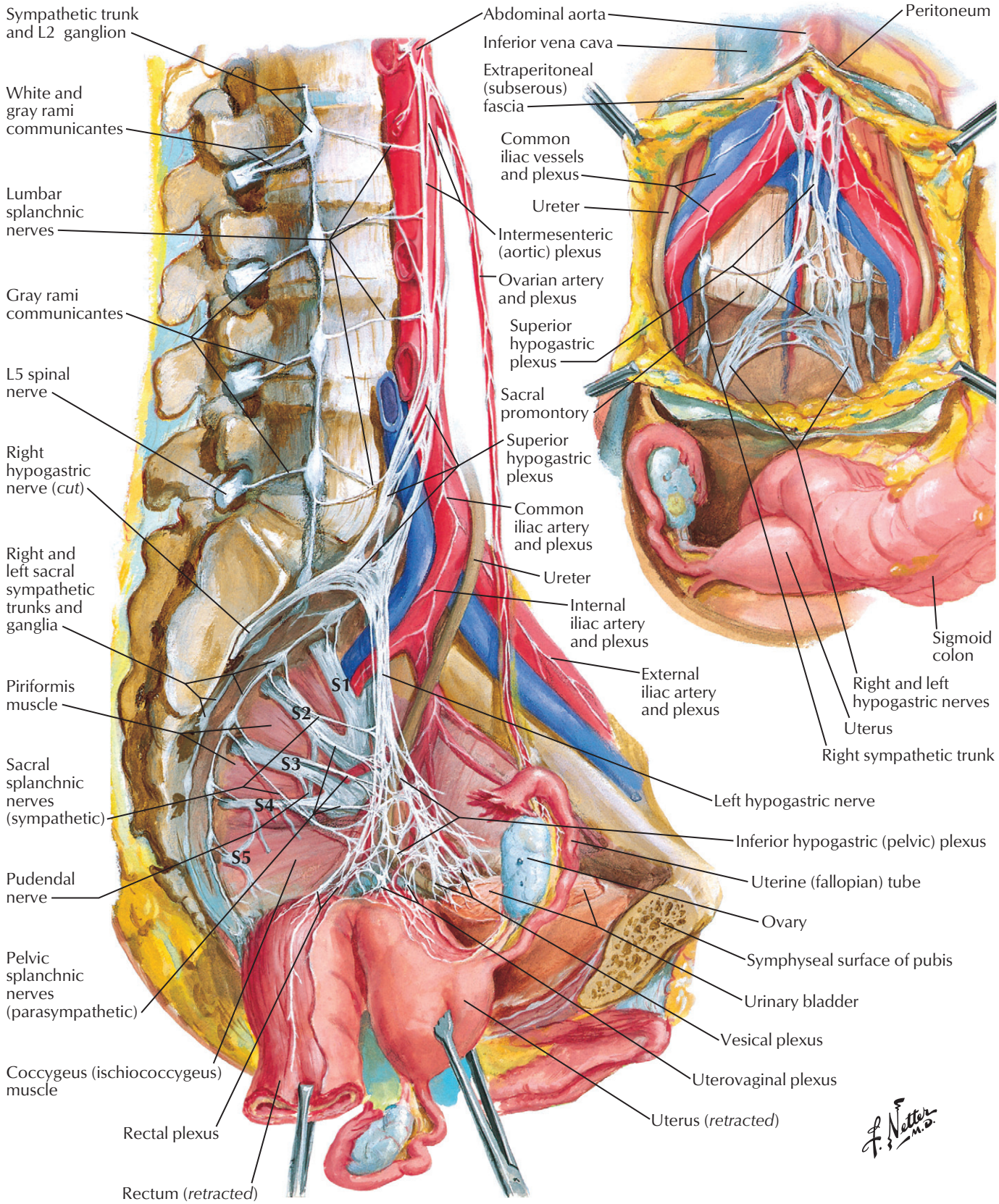
See also **Plate 297**

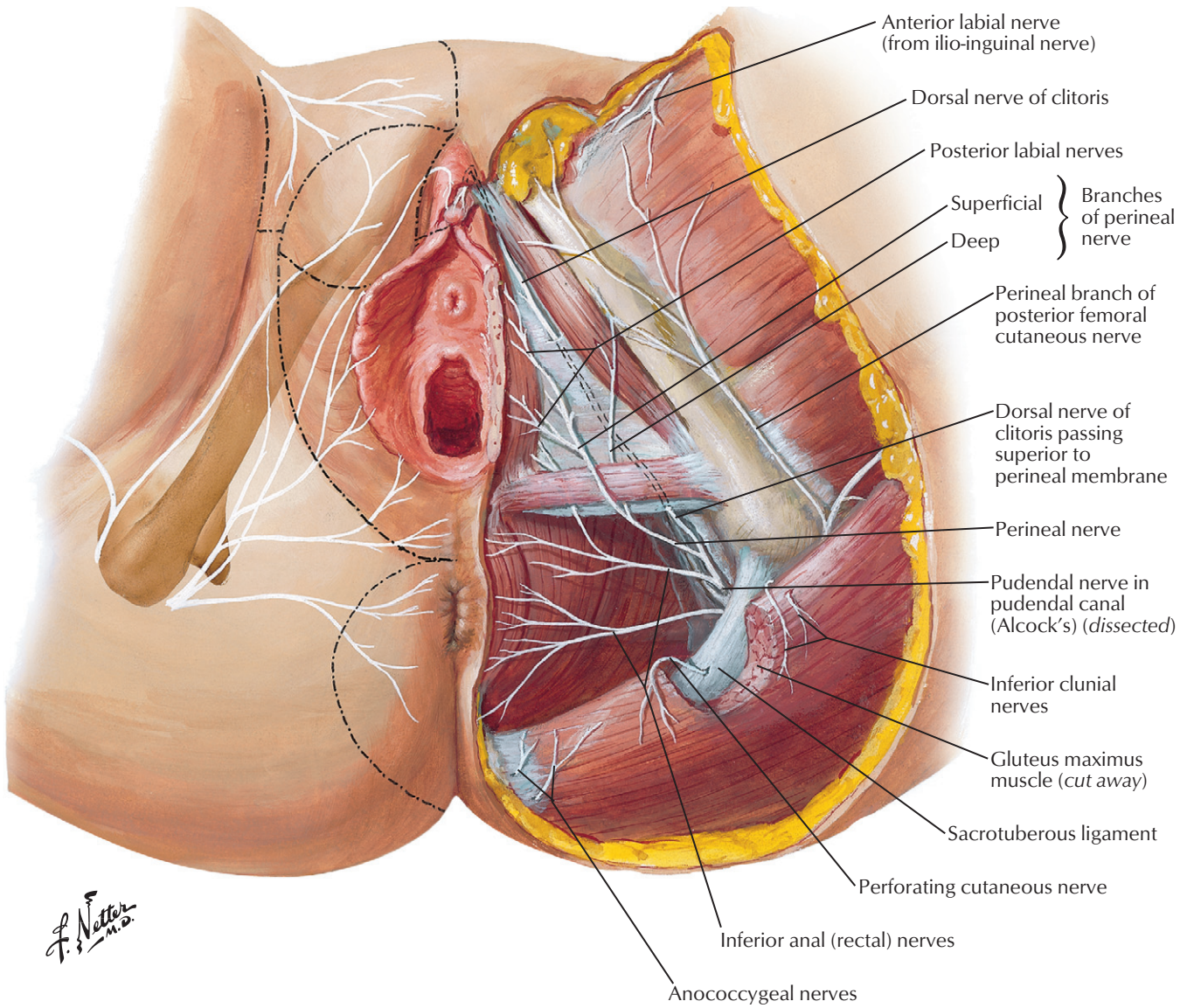


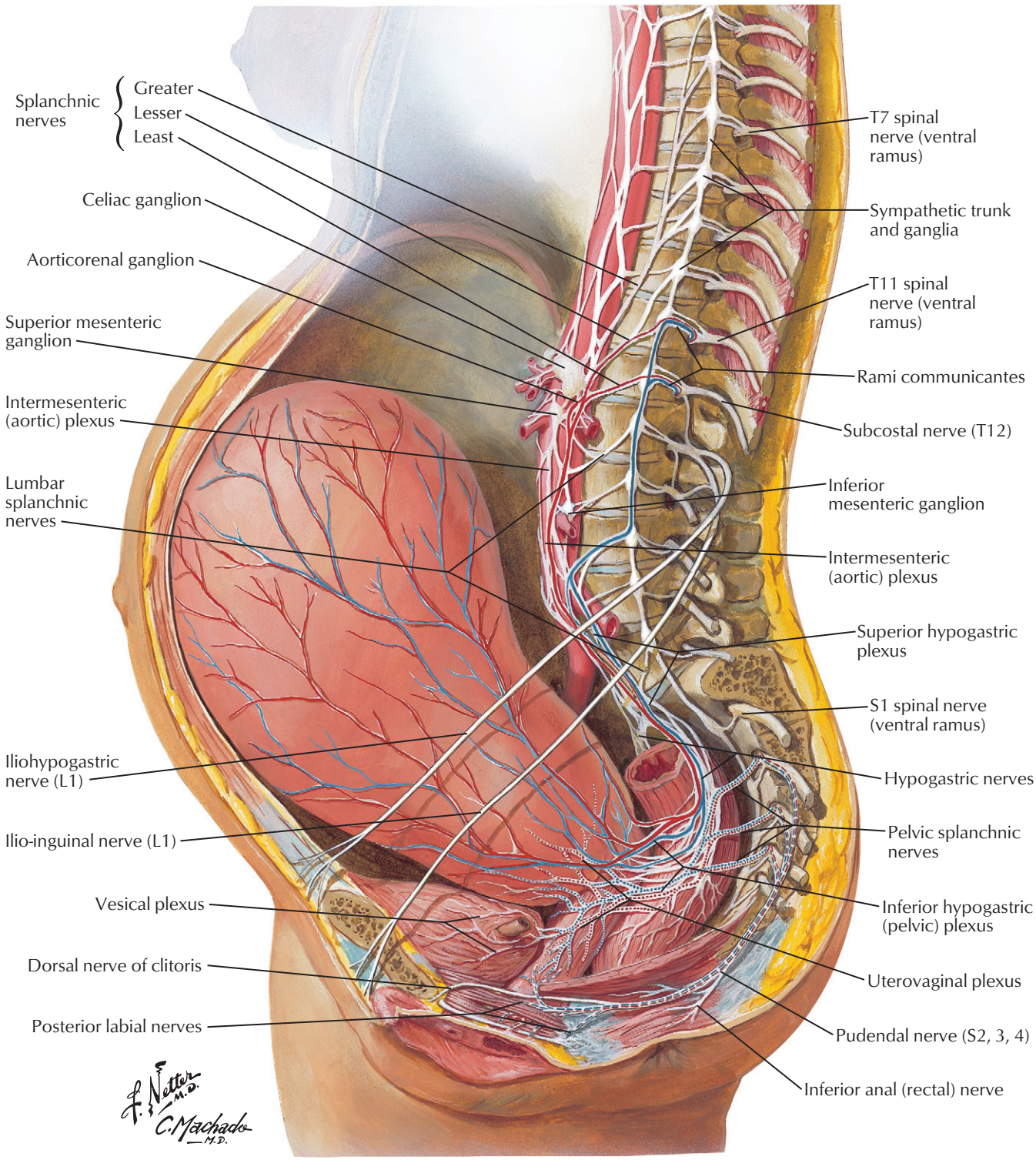

Posterior scrotal nerves
Perineal nerves
Superficial
Deep
Dorsal nerve of penis
Perineal membrane (*cut to show neurovascular structures on superior aspect of perineal membrane*)
Dorsal nerve of penis (continuation of pudendal nerve supplying muscles on superior aspect of perineal membrane)
Superficial perineal (Colles') fascia (*cut to open superficial perineal space*)
Superficial and deep branches of perineal nerve
Dorsal nerve of penis (passes superior to perineal membrane)
Perineal nerve
Obturator fascia (of obturator internus muscle)
Posterior femoral cutaneous nerve
Pudendal canal (Alcock's) (*opened up*)
Pudendal nerve
Inferior clunial nerves on gluteus maximus muscle
Inferior anal (rectal) nerves
Perforating cutaneous nerve
Anococcygeal nerve
Sacrotuberous ligament (*cut*)
Piriformis muscle
Coccygeus (ischiococcygeus) muscle
Levator ani muscle
Obturator internus muscle
Ischial spine
Pudendal nerve

Nerves of Pelvic Viscera: Female

See also **Plate 297**




Anterior labial nerve (from ilio-inguinal nerve)
Dorsal nerve of clitoris
Posterior labial nerves
Superficial
Deep
Branches of perineal nerve
Perineal branch of posterior femoral cutaneous nerve
Dorsal nerve of clitoris passing superior to perineal membrane
Perineal nerve
Pudendal nerve in pudendal canal (Alcock's) (*dissected*)
Inferior clunial nerves
Gluteus maximus muscle (*cut away*)
Sacrotuberous ligament
Perforating cutaneous nerve
Inferior anal (rectal) nerves
Anococcygeal nerves
F. Netter M.D.



Sensory fibers from uterine body and fundus accompany sympathetic fibers via hypogastric plexuses to T11, 12 (L1?)

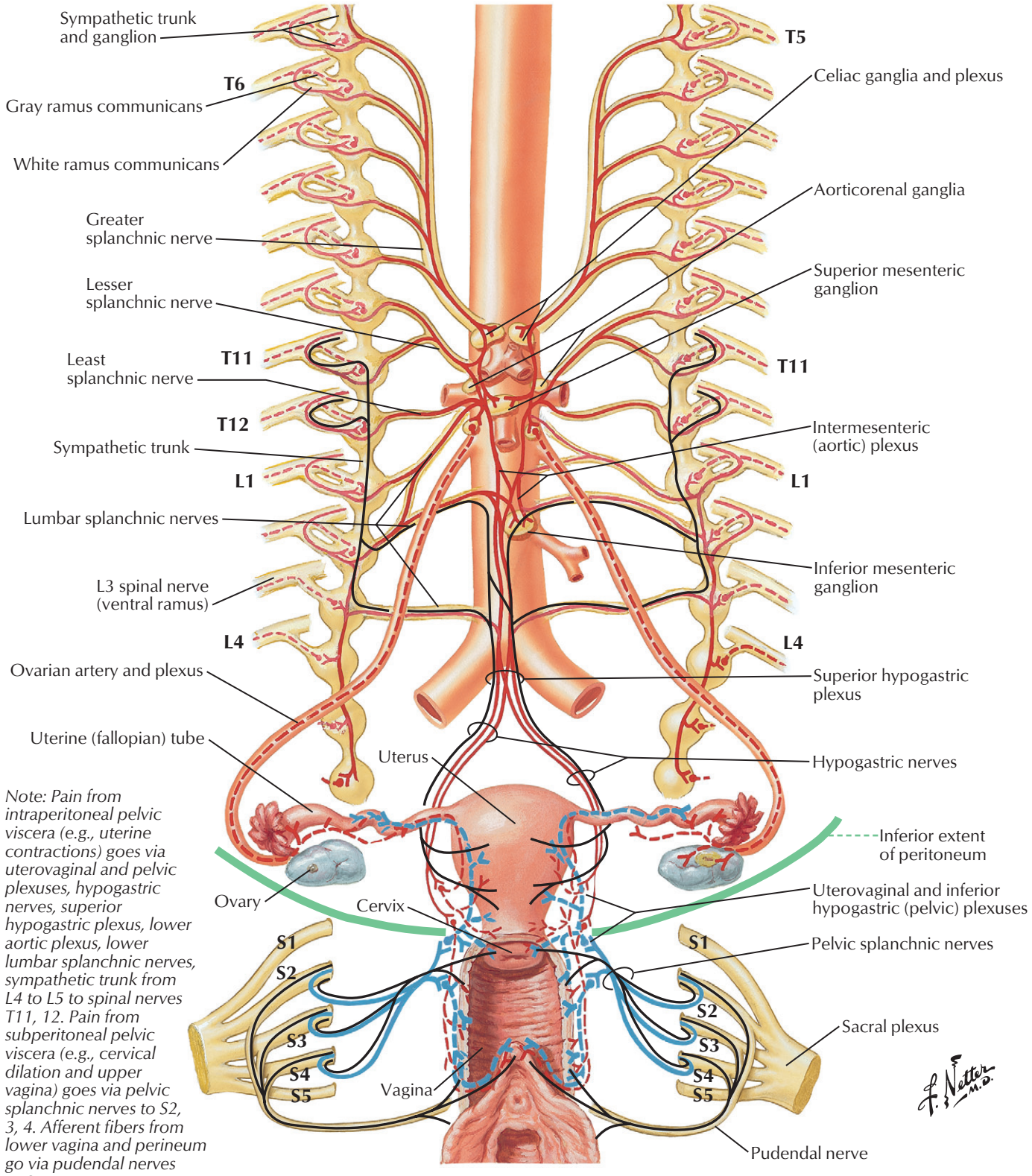
Motor fibers to uterine body and fundus (sympathetic)

Sensory fibers from cervix and upper vagina accompany pelvic splanchnic nerves (parasympathetic) to S2, 3, 4

Motor fibers to lower uterine segment, cervix, and upper vagina (parasympathetic)

Sensory fibers from lower vagina and perineum accompany somatic fibers via pudendal nerve to S2, 3, 4

Motor fibers to lower vagina and perineum via pudendal nerve (somatic)



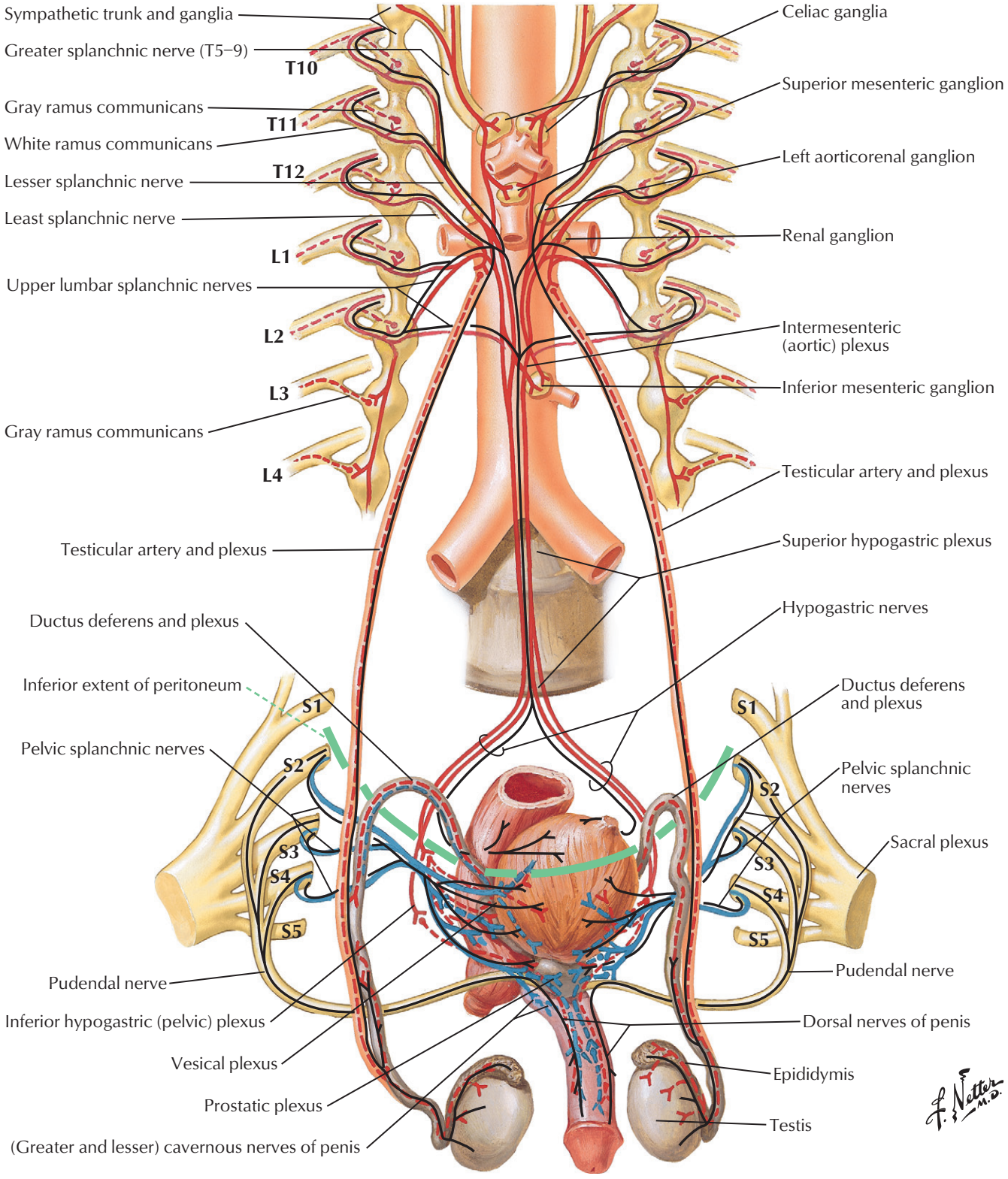
Note: Pain from intraperitoneal pelvic viscera (e.g., uterine contractions) goes via uterovaginal and pelvic plexuses, hypogastric nerves, superior hypogastric plexus, lower aortic plexus, lower lumbar splanchnic nerves, sympathetic trunk from L4 to L5 to spinal nerves T11, 12. Pain from subperitoneal pelvic viscera (e.g., cervical dilation and upper vagina) goes via pelvic splanchnic nerves to S2, 3, 4. Afferent fibers from lower vagina and perineum go via pudendal nerves to S2, 3, 4.

Sympathetic fibers { **Preganglionic** ——— **Postganglionic** - - - -

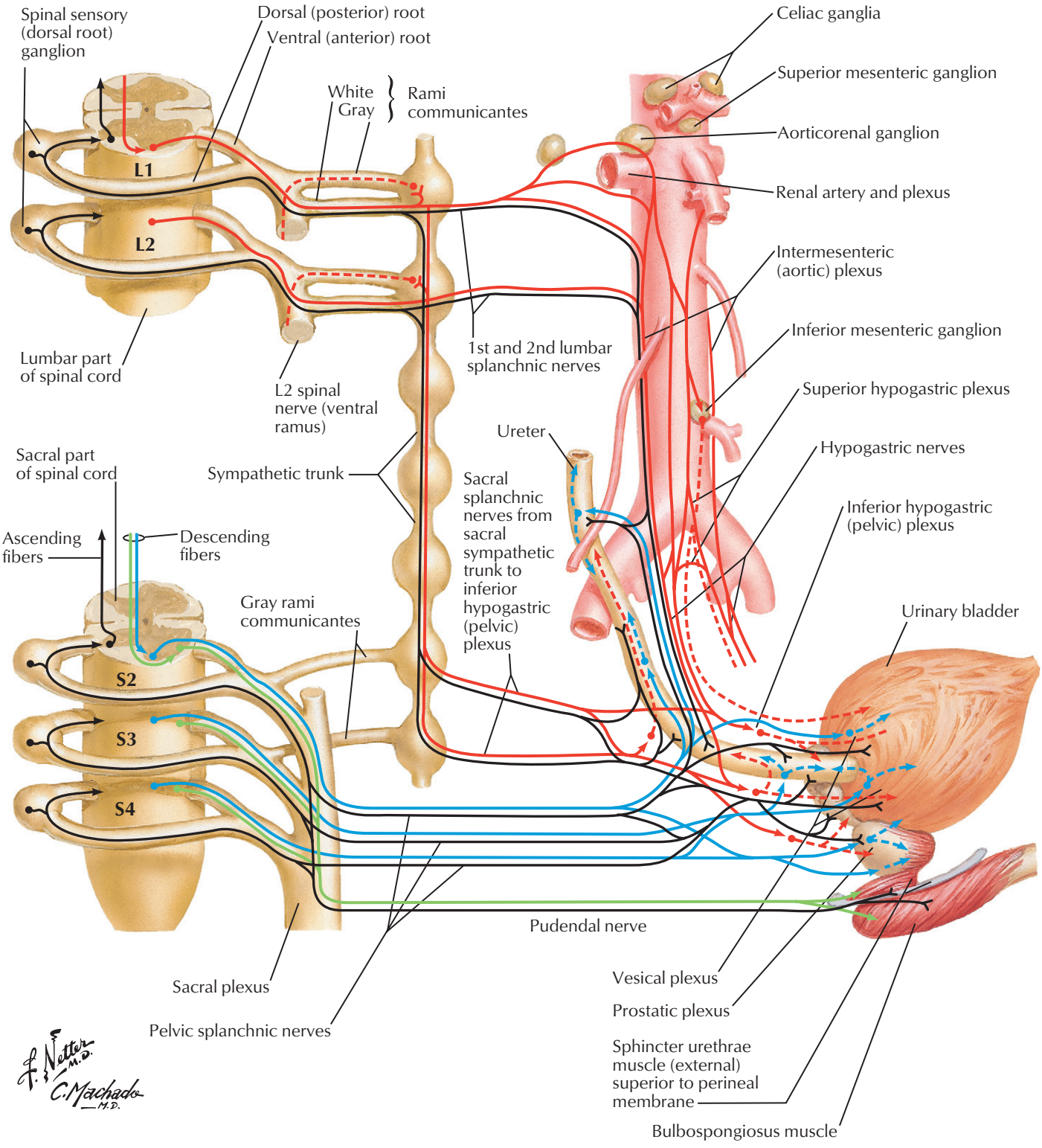
Parasympathetic fibers { **Preganglionic** ——— **Postganglionic** - - - -

Afferent fibers ———

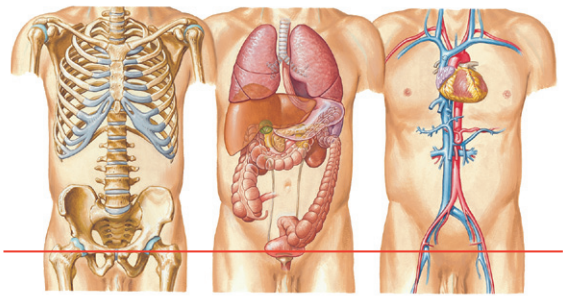
Innervation of Male Reproductive Organs: Schema

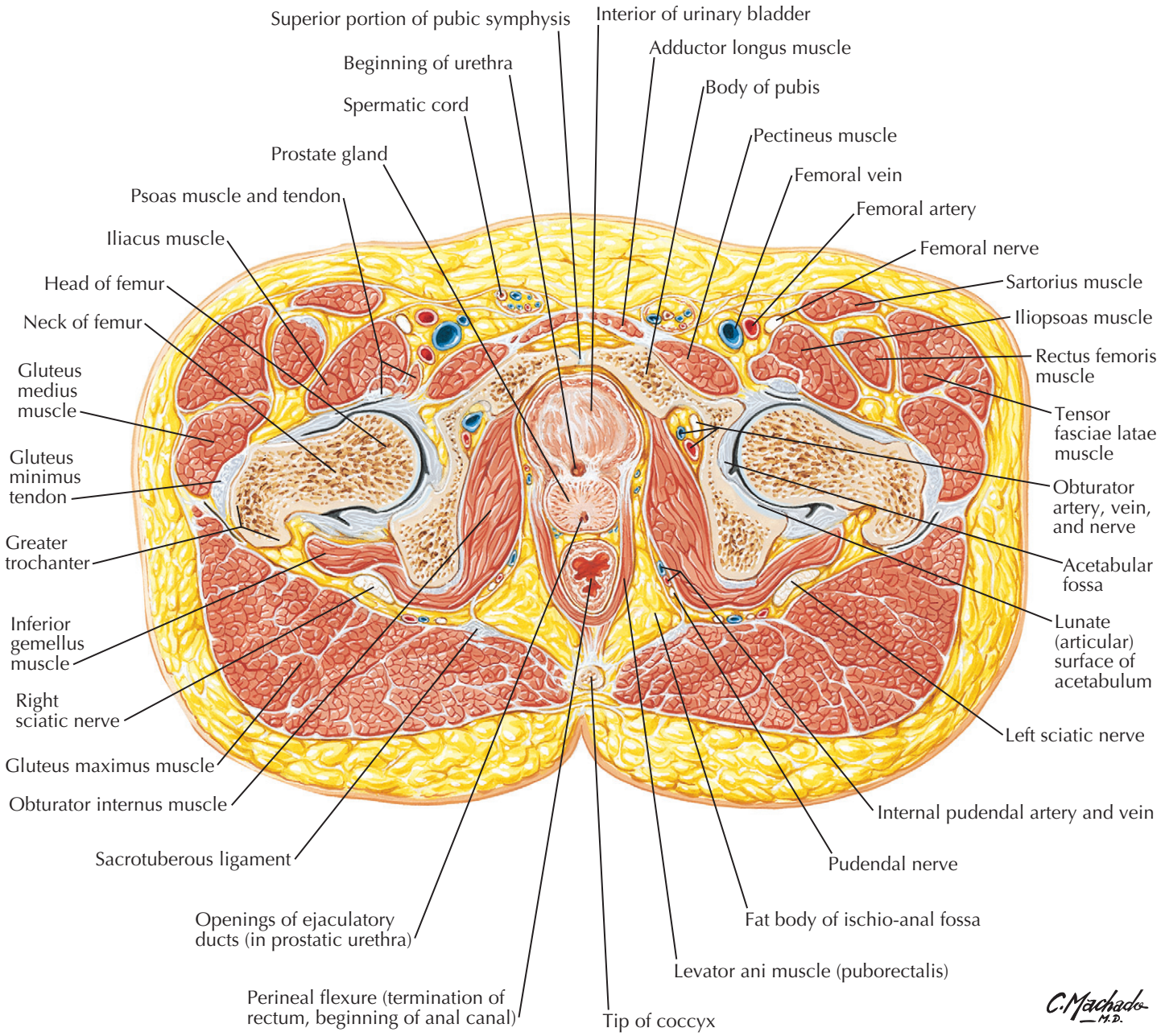


Innervation of Urinary Bladder and Lower Ureter: Schema

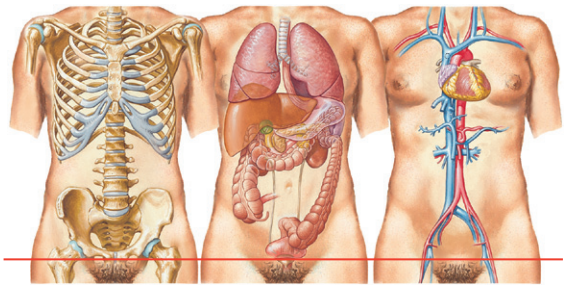


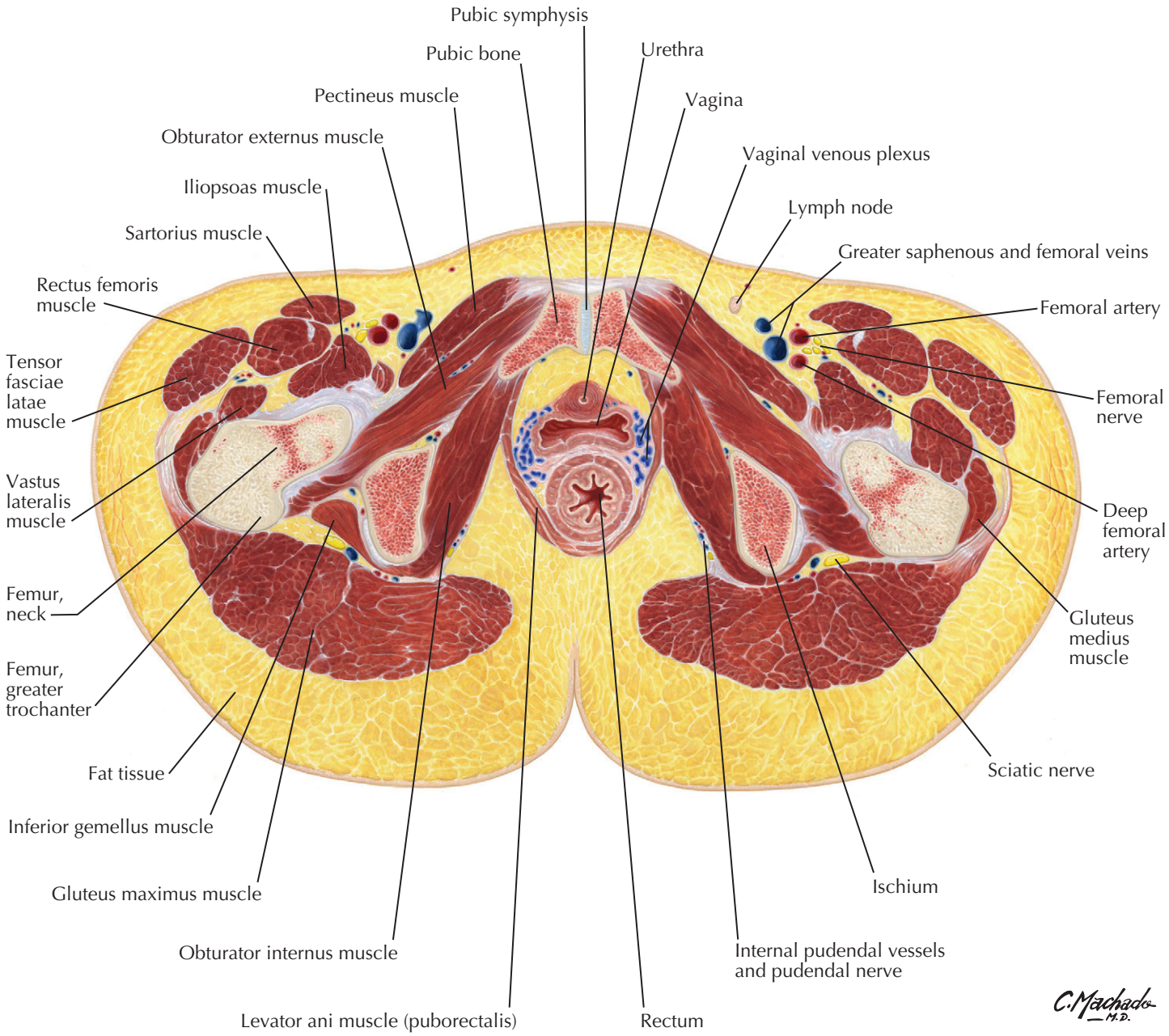
Male Pelvis: Cross Section of Bladder-Prostate Junction





Female Pelvis: Cross Section of Vagina-Urethra



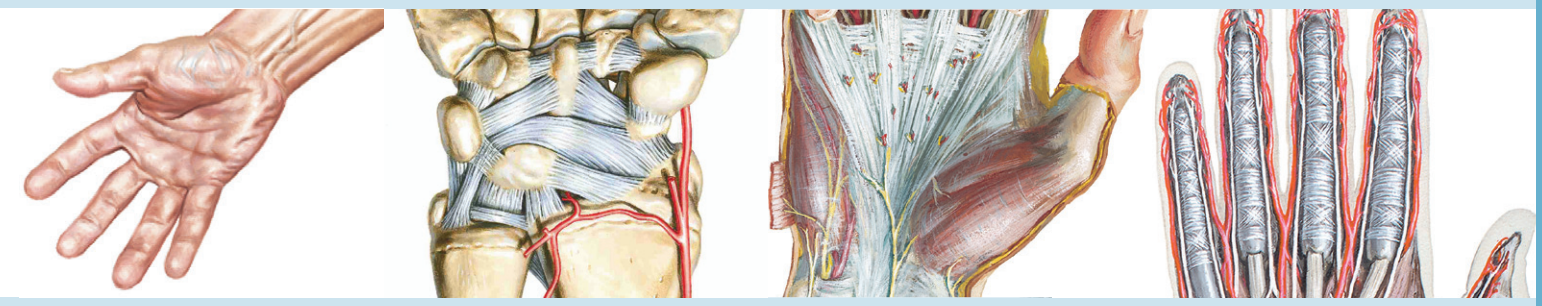


MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Bulbospongiosus	*Male:* median raphe, bulb of penis, perineal body *Female:* perineal body	*Male:* perineal membrane, corpus cavernosum, bulb of penis *Female:* dorsum of clitoris, inferior fascia of urogenital diaphragm, bulb of vestibule, pubic arch	Deep branch of perineal nerve from pudendal nerve	*Male:* compresses bulb of penis, forces blood into body of penis during erection, removes urine from urethra and semen during ejaculation *Female:* constricts vaginal orifice, assists in expressing secretions of greater vestibular gland, forces blood into body of clitoris	Internal pudendal artery and its branch (perineal artery)	Perineal
Coccygeus (ischiococcygeus)	Ischial spine, sacrospinous ligament	Inferior sacrum, coccyx	Ventral rami of lower sacral nerves	Supports pelvic viscera, draws coccyx forward	Inferior gluteal artery	Pelvic floor
Compressor urethrae (female only)	Ischiopubic ramus	Anterior aspect of urethra	Perineal branches of pudendal nerve	Sphincter of urethra	Perineal branch of internal pudendal artery	Perineal
Cremaster	Lower edge of internal oblique and middle of inguinal ligament	Pubic tubercle, crest of pubis	Genital branch of genitofemoral nerve	Retracts testicle	Cremasteric branch of inferior epigastric artery	Spermatic cord
Deep transverse perineal	Inner surface of inferior ischial rami	*Male:* medial tendinous raphe and perineal body *Female:* sides of vagina	Perineal branches of pudendal nerve	Stabilizes perineal body, supports prostate/vagina	Perineal branch of internal pudendal artery	Perineal
External anal sphincter	Tip of coccyx, anococcygeal ligament	Deeper fibers surround anal canal, attach posteriorly to coccyx and anteriorly to central point of perineum	Perineal and inferior rectal branches of pudendal nerve	Closes anal orifice	Inferior rectal and transverse perineal artery	Perineal
Iliacus	Superior 2/3 of iliac fossa, ala of sacrum, anterior sacro-iliac ligaments	Lesser trochanter of femur and shaft inferior to it, to psoas major tendon	Femoral nerve	Flexes thigh at hips and stabilizes hip joint, acts with psoas major	Iliac branches of iliolumbar artery	Anterior thigh
Ischiocavernosus	Inferior internal surface of ischiopubic ramus, ischial tuberosity	Crus of penis or clitoris	Deep branch of perineal nerve from pudendal nerve	Forces blood into body of penis and clitoris during erection	Internal pudendal artery and its branch (perineal artery)	Perineal
Levator ani	Body of pubis, tendinous arch of obturator fascia, ischial spine	Perineal body, coccyx, anococcygeal raphe, walls of prostate or vagina, rectum, anal canal	Ventral rami of lower sacral nerves, perineal nerve	Supports pelvic viscera, raises pelvic floor	Inferior gluteal artery, internal pudendal artery and its branches (inferior rectal and perineal arteries)	Pelvic floor
Obturator internus	Pelvic surface of obturator membrane and surrounding bone	Medial surface of greater trochanter of femur	Nerve to obturator internus	Laterally rotates extended thigh, abducts flexed thigh at hip	Internal pudendal and obturator arteries	Gluteal region

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Piriformis	Anterior surface of sacral segments 2–4, sacrotuberous ligament	Superior border of greater trochanter of femur	Ventral rami of L5, S1, S2	Laterally rotates extended thigh, abducts flexed thigh at hip	Superior and inferior gluteal arteries, internal pudendal artery	Gluteal region
Puborectalis	Lower part of pubic symphysis, superior fascia of urogenital diaphragm	Loops around rectum; no distal attachment	Nerve to levator ani muscle			Pelvic floor
Sphincter urethrae	External fibers from junction of inferior pubic and ischial rami and adjacent fascia; internal fibers pass medially to surround membranous urethra	*Male:* median raphe in front and behind urethra *Female:* encloses urethra, attaches to sides of vagina	Perineal branches of pudendal nerve	Compresses urethra at end of micturition; in female also compresses the distal vagina	Perineal branch of internal pudendal artery	Perineal
Sphincter urethrovaginalis (female only)	Perineal body	Passes forward and anterior around urethra	Perineal branches of pudendal nerve	Sphincter of urethra and vagina	Perineal branch of pudendal artery	Perineal
Superficial transverse perineal	Ischial rami and tuberosities	Central tendon (perineal body)	Perineal branches of pudendal nerve	Stabilizes central tendon	Perineal branch of internal pudendal artery	Perineal

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6 UPPER LIMB

Section

Topographic Anatomy

Plate 398

398 Upper Limb: Surface Anatomy

Cutaneous Anatomy

Plates 399–403

399 Dermatomes of Upper Limb

400 Cutaneous Innervation of Upper Limb

401 Cutaneous Nerves and Superficial Veins of Shoulder and Arm

402 Cutaneous Nerves and Superficial Veins of Forearm

403 Lymph Vessels and Nodes of Upper Limb

Shoulder and Axilla

Plates 404–416

404 Clavicle and Sternoclavicular Joint

405 Humerus and Scapula: Anterior Views

406 Humerus and Scapula: Posterior View

407 Shoulder: Anteroposterior Radiograph

408 Shoulder (Glenohumeral Joint)

409 Muscles of Shoulder

410 Axilla: Posterior Wall

411 Muscles of Rotator Cuff

412 Pectoral, Clavipectoral, and Axillary Fasciae

413 Scapulothoracic and Scapulohumeral Dissection

414 Axillary Artery and Anastomoses around Scapula

415 Axilla (Dissection): Anterior View
416 Brachial Plexus: Schema

Arm

Plates 417–421

417 Muscles of Arm: Anterior Views
418 Muscles of Arm: Posterior Views
419 Brachial Artery in Situ
420 Arteries of Arm and Proximal Forearm
421 Arm: Serial Cross Sections

Elbow and Forearm

Plates 422–438

422 Bones of Elbow
423 Elbow: Radiographs
424 Ligaments of Elbow
425 Bones of Forearm
426 Individual Muscles of Forearm: Rotators of Radius
427 Individual Muscles of Forearm: Extensors of Wrist and Digits
428 Individual Muscles of Forearm: Flexors of Wrist
429 Individual Muscles of Forearm: Flexors of Digits
430 Muscles of Forearm (Superficial Layer): Posterior View
431 Muscles of Forearm (Deep Layer): Posterior View
432 Muscles of Forearm (Superficial Layer): Anterior View
433 Muscles of Forearm (Intermediate Layer): Anterior View
434 Muscles of Forearm (Deep Layer): Anterior View
435 Arteries of Forearm
436 Forearm: Serial Cross Sections, Anterior View
437 Attachments of Muscles of Forearm: Anterior View
438 Attachments of Muscles of Forearm: Posterior View

Wrist and Hand

Plates 439–458

439 Carpal Bones
440 Movements of Wrist
441 Ligaments of Wrist
442 Ligaments of Wrist (continued)
443 Bones of Wrist and Hand
444 Wrist and Hand: Radiographs
445 Metacarpophalangeal and Interphalangeal Ligaments
446 Wrist and Hand: Superficial Palmar Dissections
447 Wrist and Hand: Deeper Palmar Dissections
448 Lumbrical Muscles and Bursae, Spaces, and Sheaths: Schema
449 Flexor Tendons, Arteries, and Nerves at Wrist
450 Bursae, Spaces, and Tendon Sheaths of Hand
451 Flexor and Extensor Tendons in Fingers
452 Intrinsic Muscles of Hand
453 Arteries and Nerves of Hand: Palmar Views
454 Wrist and Hand: Superficial Radial Dissection
455 Wrist and Hand: Superficial Dorsal Dissection
456 Wrist and Hand: Deep Dorsal Dissection
457 Extensor Tendons at Wrist
458 Fingers

Neurovasculature

Plates 459–466

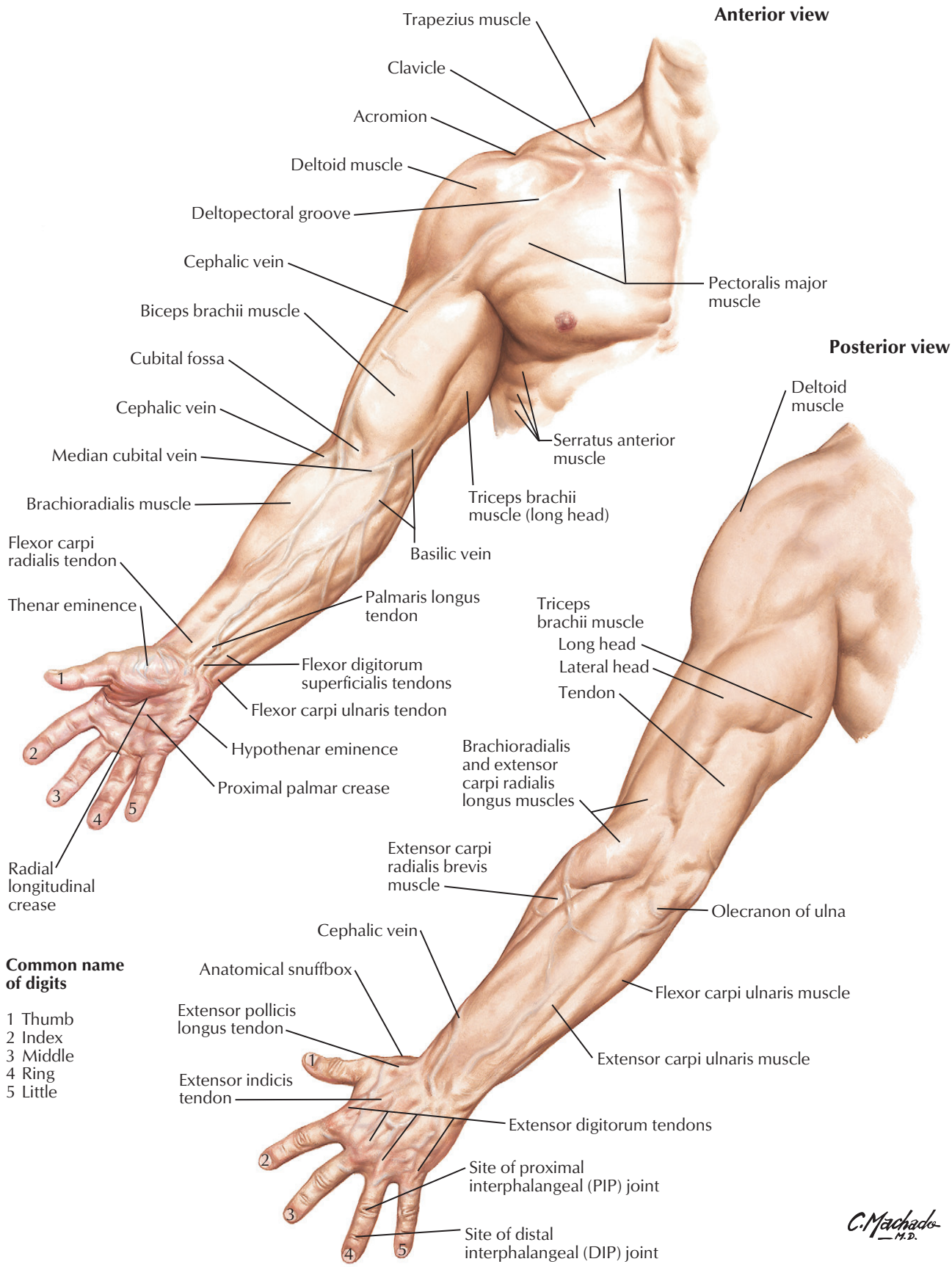
459 Cutaneous Innervation of Wrist and Hand
460 Arteries and Nerves of Upper Limb
461 Nerves of Upper Limb
462 Musculocutaneous Nerve
463 Median Nerve
464 Ulnar Nerve
465 Radial Nerve in Arm and Nerves of Posterior Shoulder
466 Radial Nerve in Forearm

Regional Scans

Plate 467

467 Shoulder MRI, CT Scan, and Arthrogram

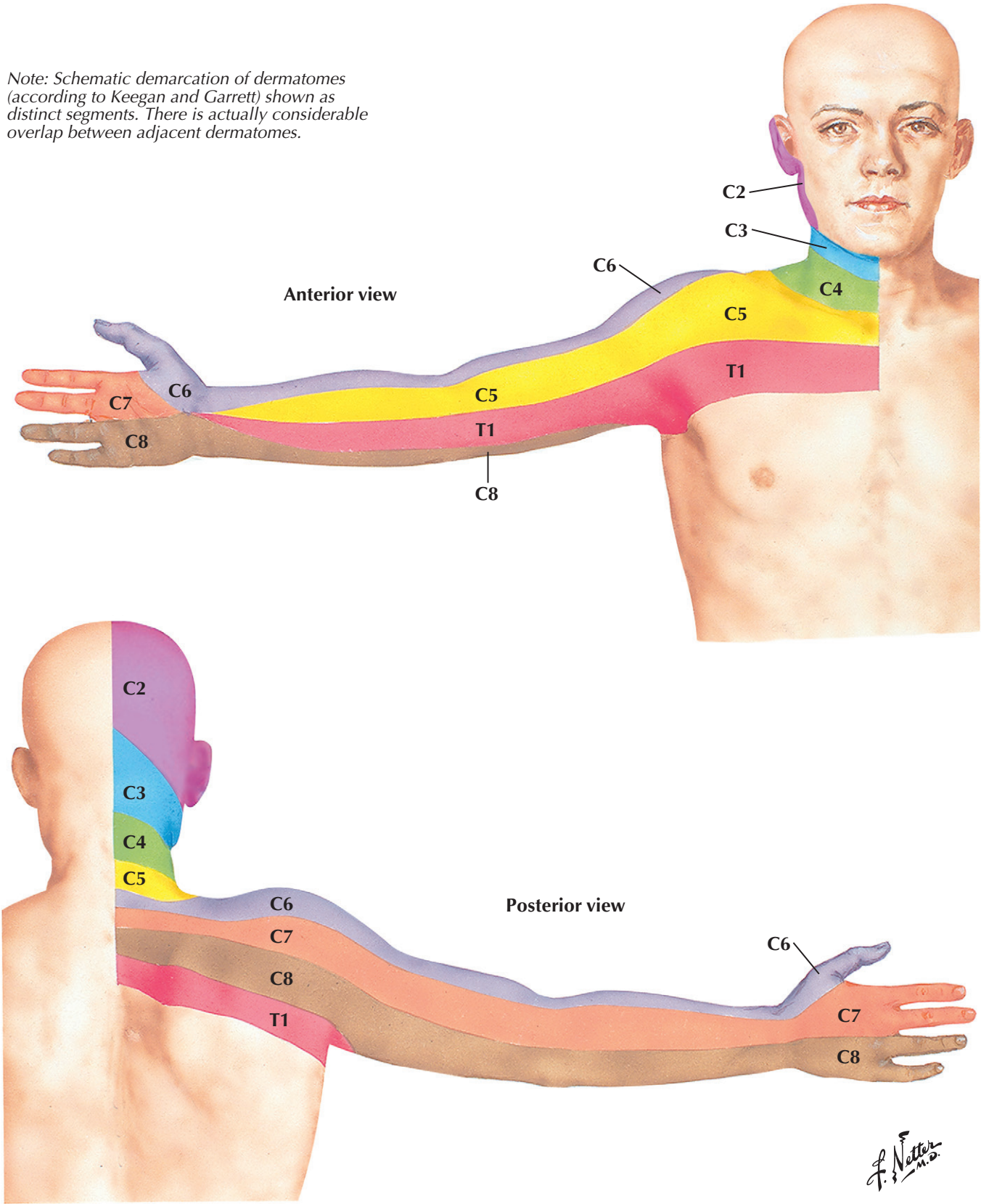
Muscle Tables

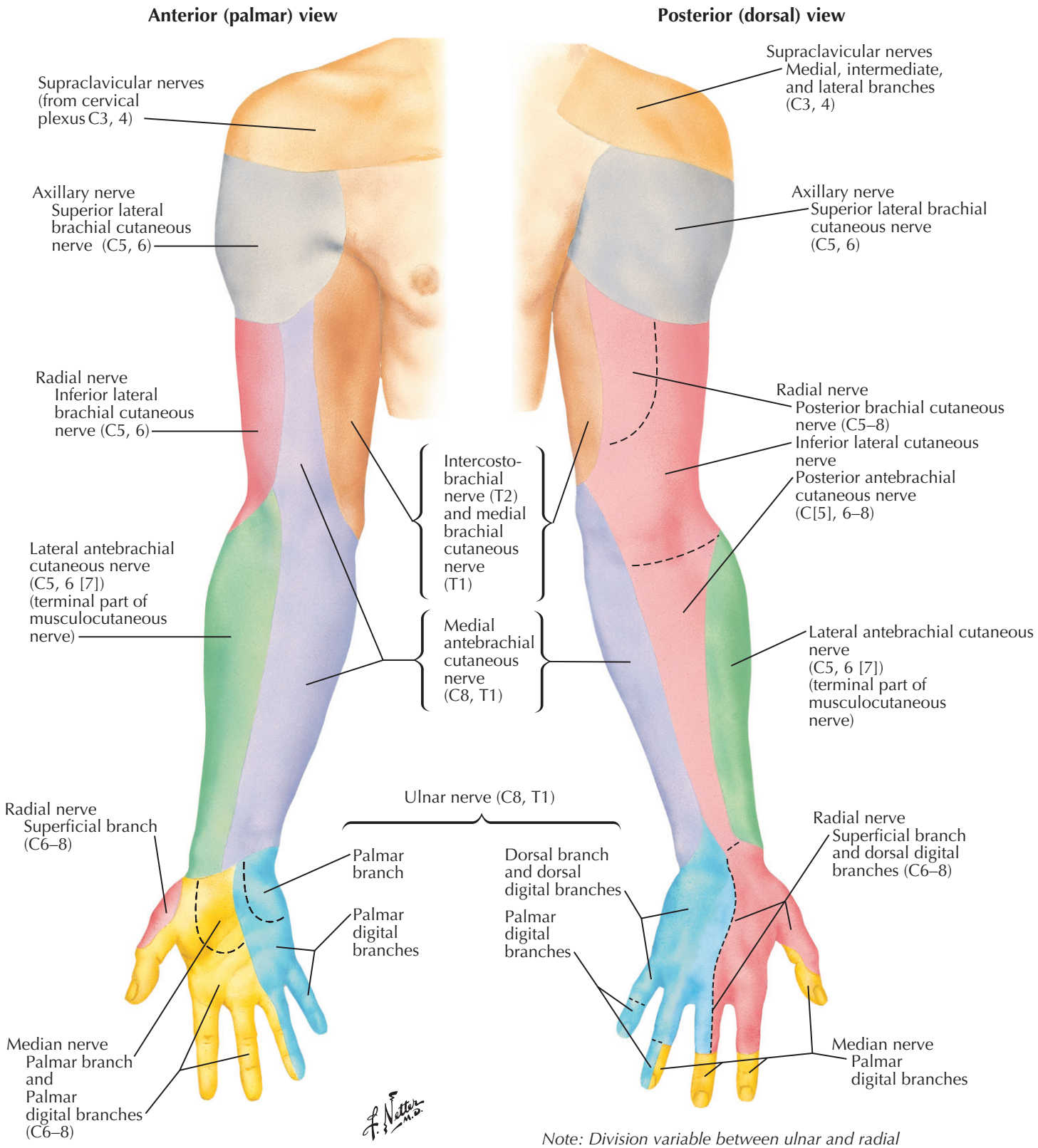

Anterior view
Trapezius muscle
Clavicle
Acromion
Deltoid muscle
Deltopectoral groove
Cephalic vein
Pectoralis major muscle
Biceps brachii muscle
Cubital fossa
Cephalic vein
Median cubital vein
Brachioradialis muscle
Serratus anterior muscle
Triceps brachii muscle (long head)
Basilic vein
Flexor carpi radialis tendon
Thenar eminence
Palmaris longus tendon
Flexor digitorum superficialis tendons
Flexor carpi ulnaris tendon
Hypothenar eminence
Proximal palmar crease
Radial longitudinal crease
Posterior view
Deltoid muscle
Triceps brachii muscle
Long head
Lateral head
Tendon
Brachioradialis and extensor carpi radialis longus muscles
Extensor carpi radialis brevis muscle
Olecranon of ulna
Cephalic vein
Anatomical snuffbox
Flexor carpi ulnaris muscle
Extensor pollicis longus tendon
Extensor carpi ulnaris muscle
Extensor indicis tendon
Extensor digitorum tendons
Site of proximal interphalangeal (PIP) joint
Site of distal interphalangeal (DIP) joint
Common name of digits
1 Thumb
2 Index
3 Middle
4 Ring
5 Little
C. Machado M.D.

Dermatomes of Upper Limb

See also Plate 162

Note: Schematic demarcation of dermatomes (according to Keegan and Garrett) shown as distinct segments. There is actually considerable overlap between adjacent dermatomes.

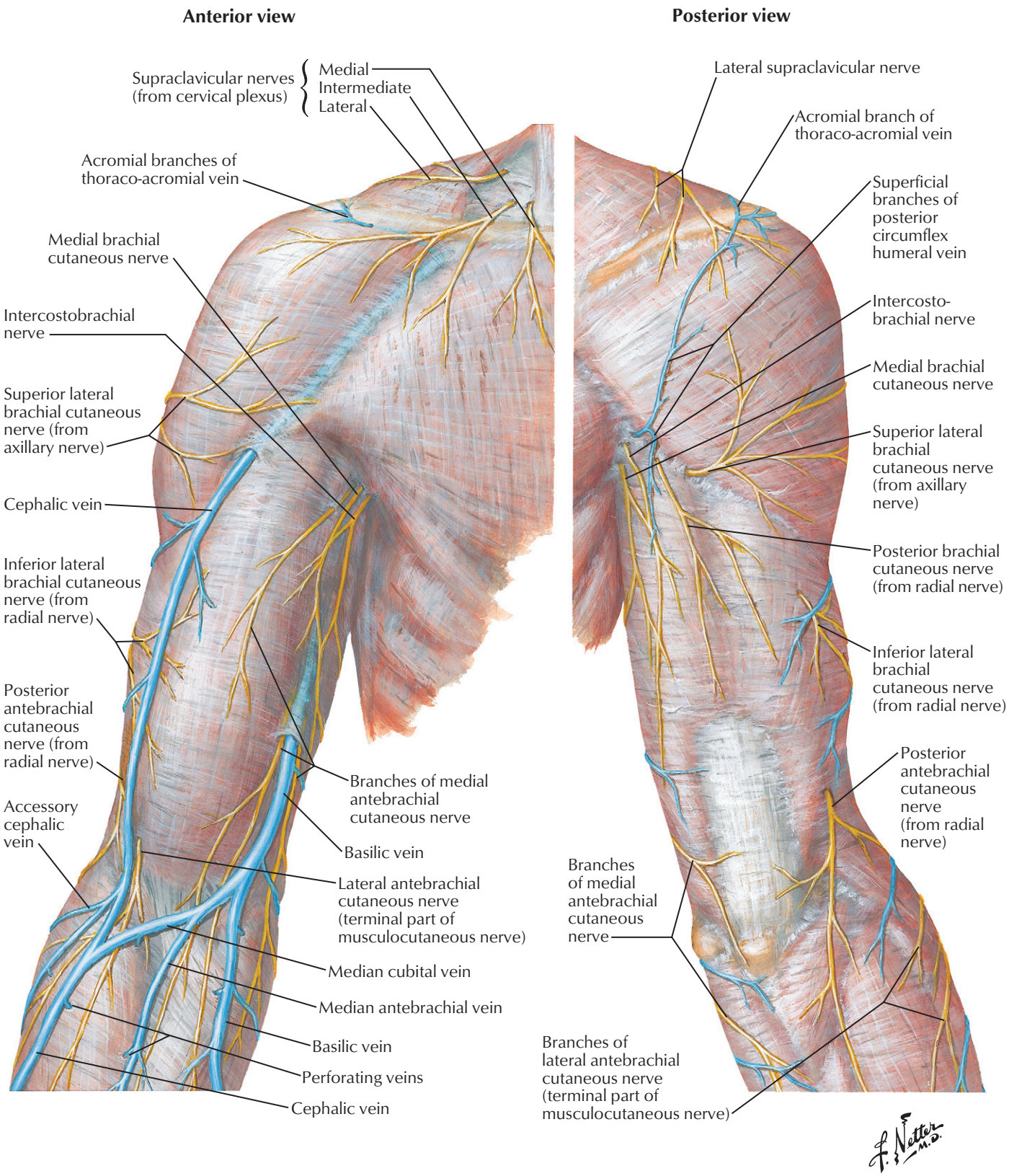


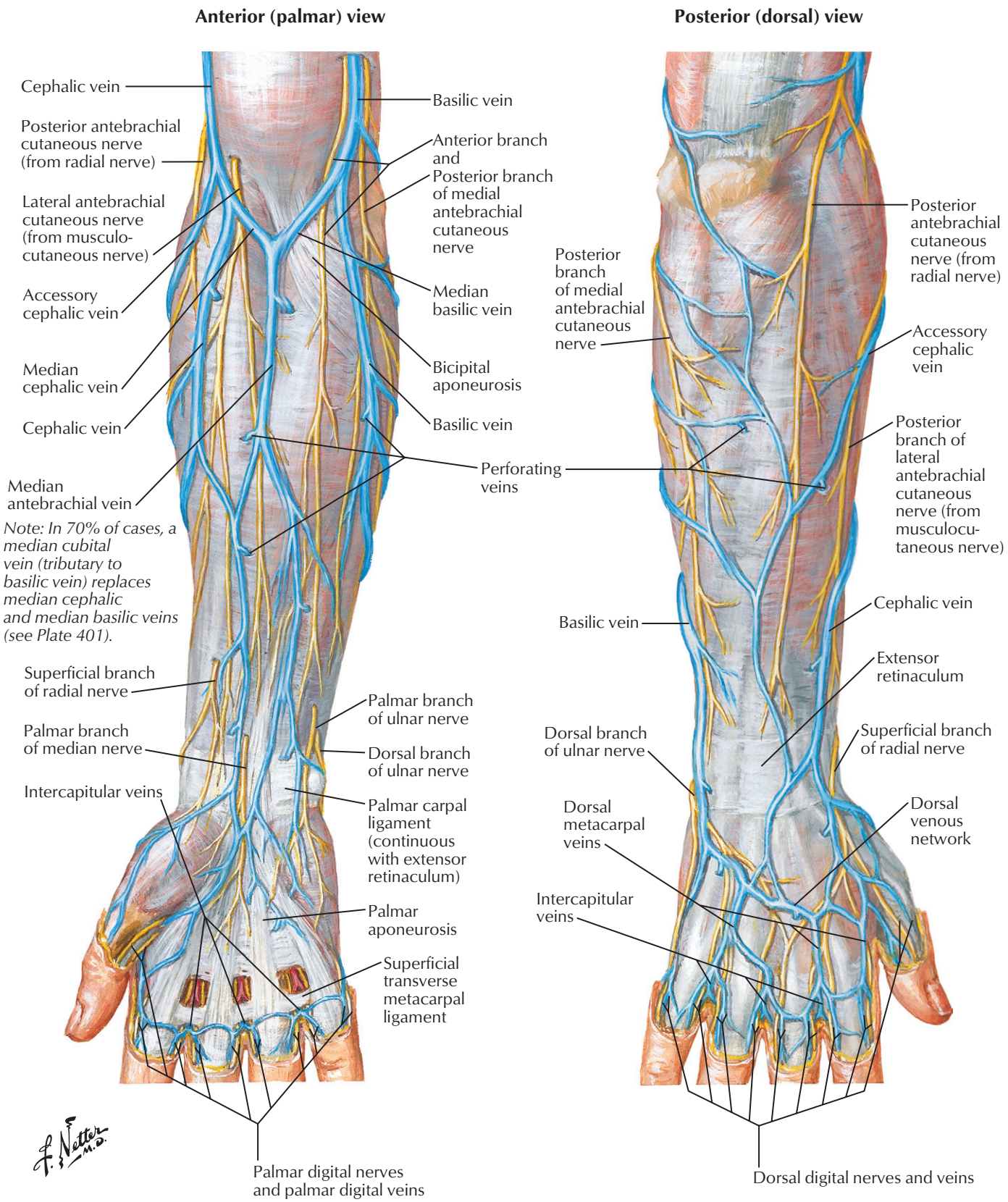


Note: Division variable between ulnar and radial innervation on dorsum of hand and often aligns with middle of 4th digit instead of 3rd digit as shown.

Cutaneous Nerves and Superficial Veins of Shoulder and Arm

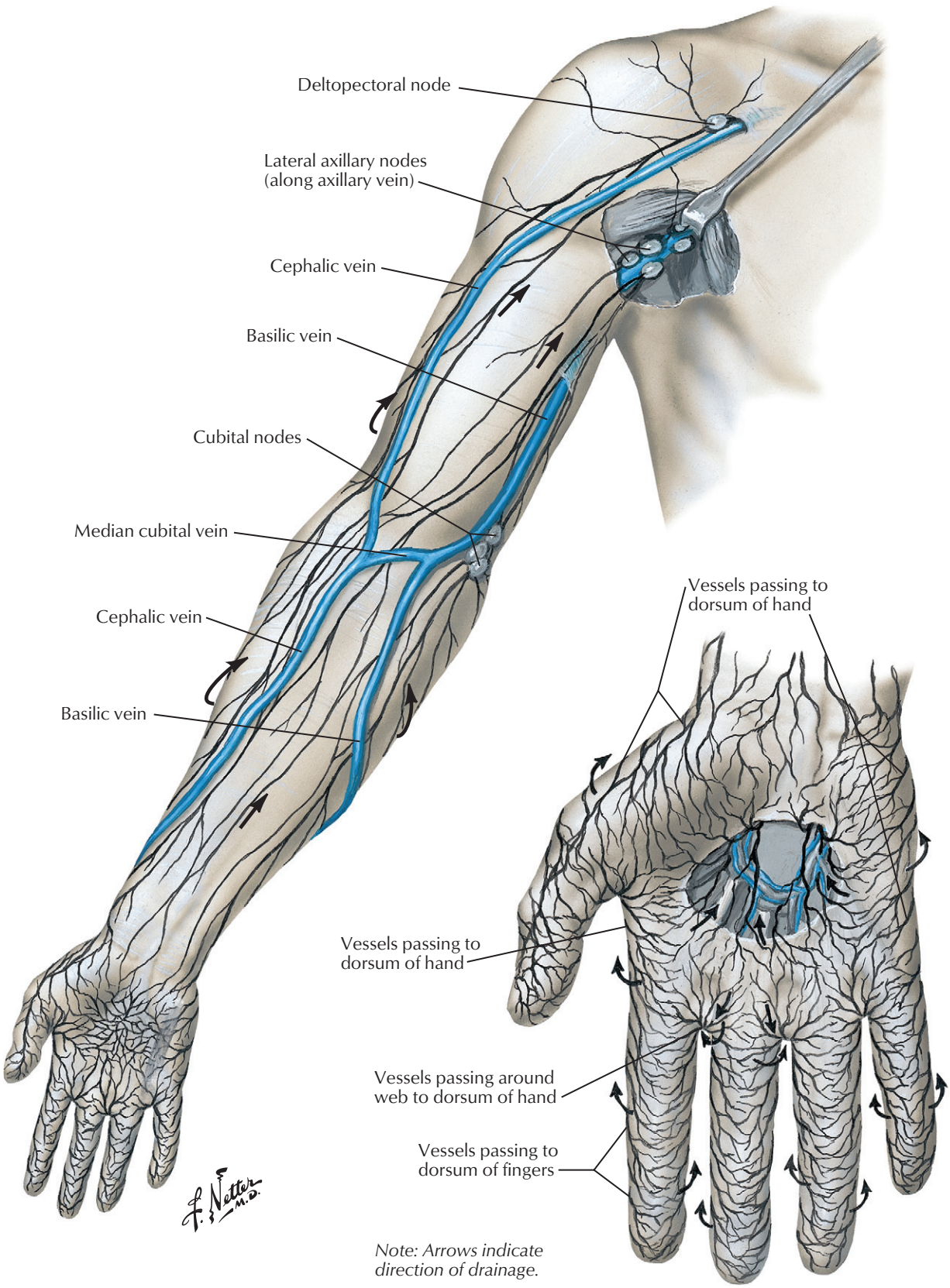
See also Plates 252, 419

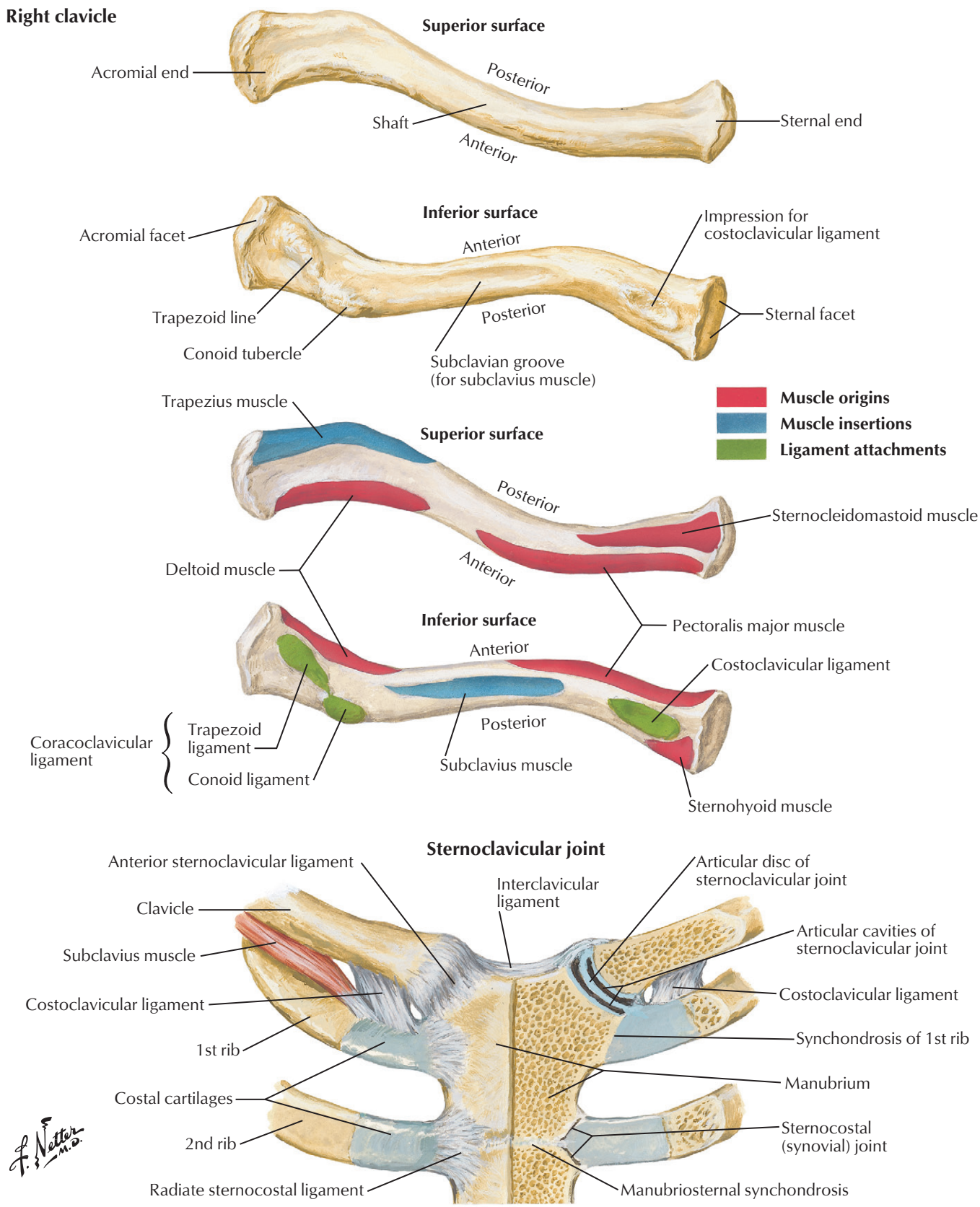



Anterior (palmar) view
Posterior (dorsal) view
Cephalic vein
Basilic vein
Posterior antebrachial cutaneous nerve (from radial nerve)
Anterior branch and Posterior branch of medial antebrachial cutaneous nerve
Lateral antebrachial cutaneous nerve (from musculo-cutaneous nerve)
Median basilic vein
Accessory cephalic vein
Median cephalic vein
Bicipital aponeurosis
Cephalic vein
Basilic vein
Perforating veins
Median antebrachial vein
Note: In 70% of cases, a median cubital vein (tributary to basilic vein) replaces median cephalic and median basilic veins (see Plate 401).
Superficial branch of radial nerve
Palmar branch of ulnar nerve
Palmar branch of median nerve
Dorsal branch of ulnar nerve
Intercapitular veins
Palmar carpal ligament (continuous with extensor retinaculum)
Palmar aponeurosis
Superficial transverse metacarpal ligament
Palmar digital nerves and palmar digital veins
Posterior branch of medial antebrachial cutaneous nerve
Posterior antebrachial cutaneous nerve (from radial nerve)
Accessory cephalic vein
Posterior branch of lateral antebrachial cutaneous nerve (from musculocu-taneous nerve)
Basilic vein
Cephalic vein
Extensor retinaculum
Dorsal branch of ulnar nerve
Superficial branch of radial nerve
Dorsal metacarpal veins
Dorsal venous network
Intercapitular veins
Dorsal digital nerves and veins

Lymph Vessels and Nodes of Upper Limb

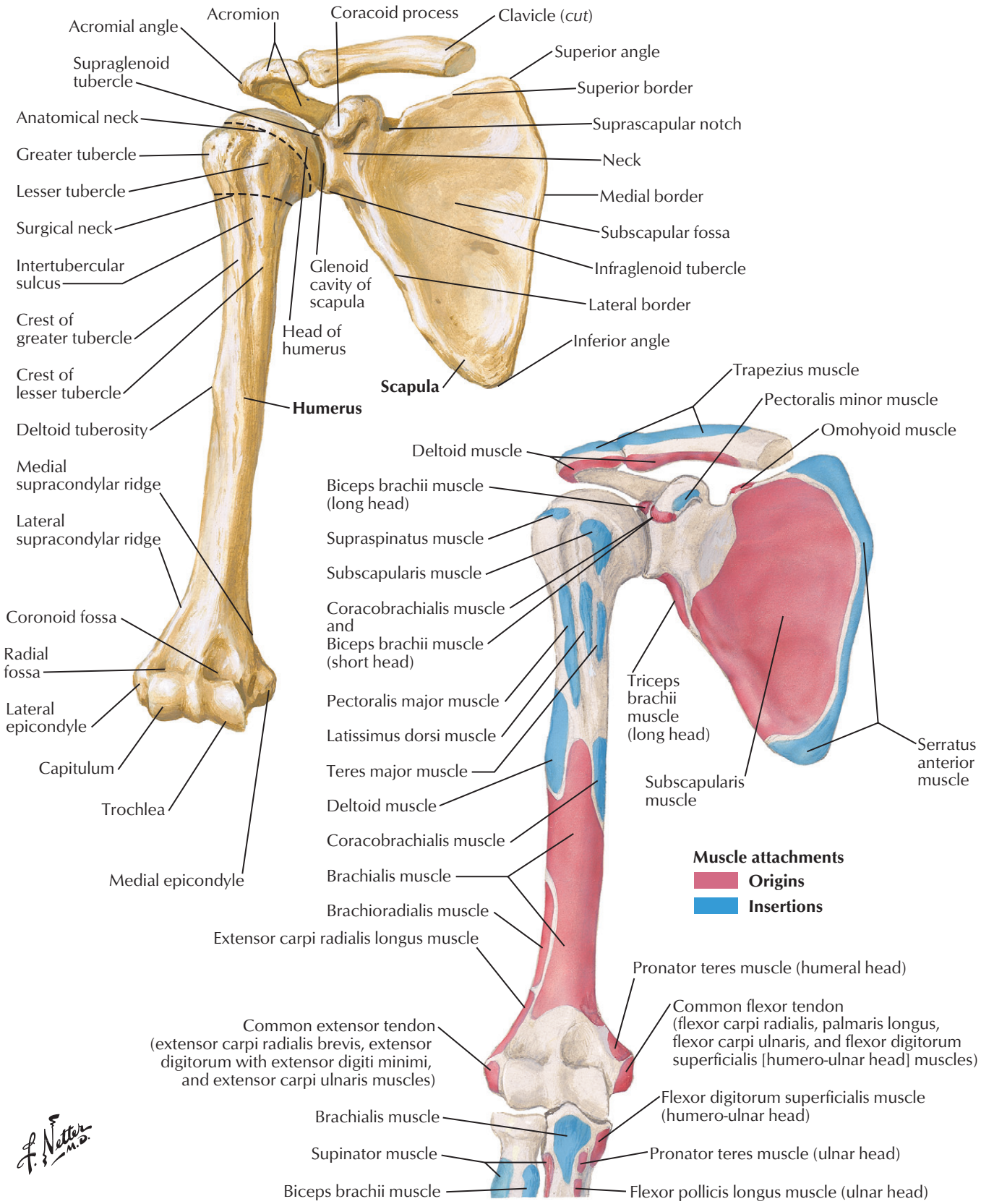
See also **Plates 181, 455**

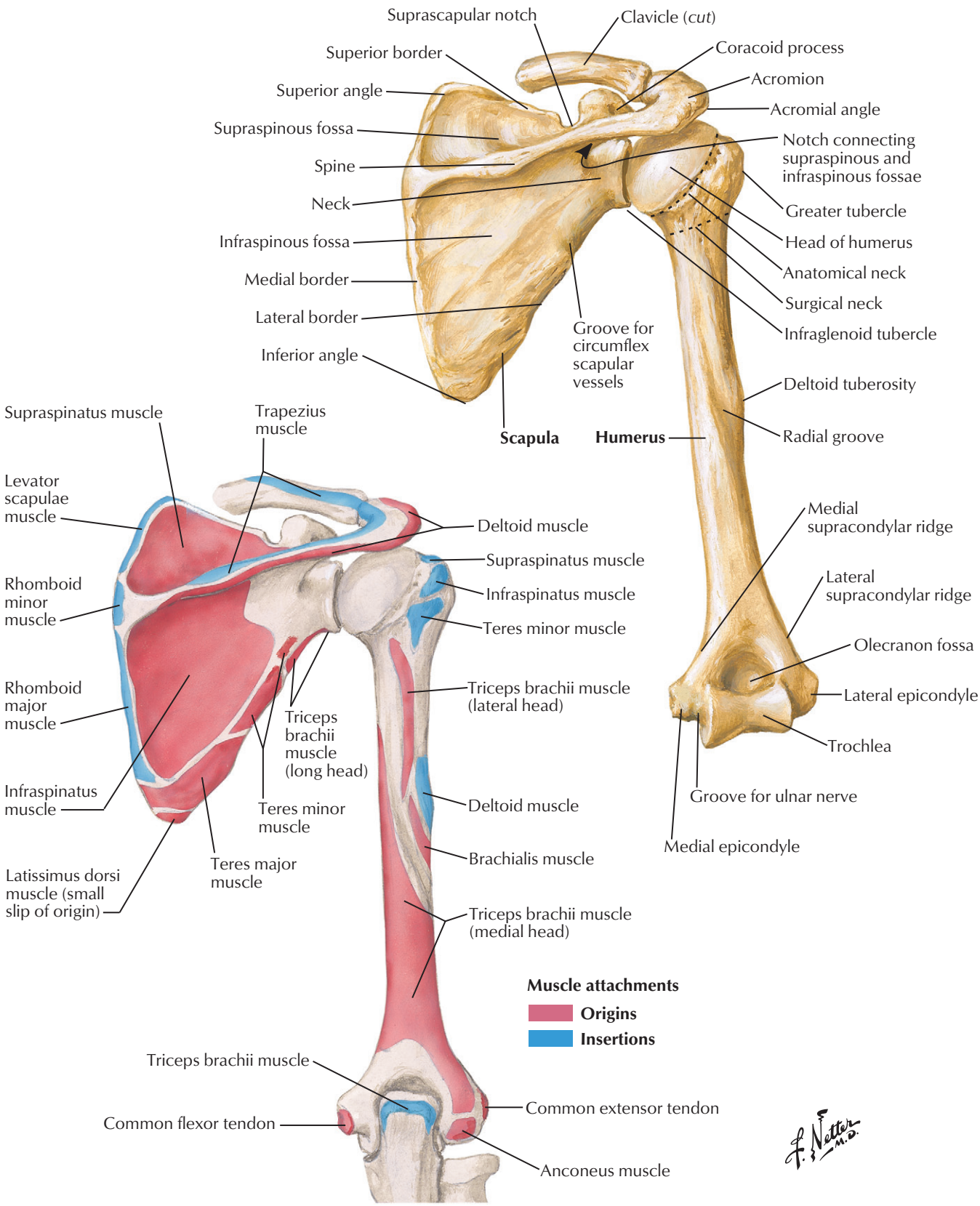



Right clavicle
Superior surface
Acromial end
Posterior
Shaft
Sternal end
Anterior
Inferior surface
Acromial facet
Anterior
Impression for costoclavicular ligament
Trapezoid line
Posterior
Sternal facet
Conoid tubercle
Subclavian groove (for subclavius muscle)
Trapezius muscle
Muscle origins
Muscle insertions
Ligament attachments
Superior surface
Posterior
Sternocleidomastoid muscle
Deltoid muscle
Anterior
Inferior surface
Pectoralis major muscle
Anterior
Costoclavicular ligament
Coracoclavicular ligament
Trapezoid ligament
Posterior
Conoid ligament
Subclavius muscle
Sternohyoid muscle
Sternoclavicular joint
Anterior sternoclavicular ligament
Articular disc of sternoclavicular joint
Interclavicular ligament
Clavicle
Articular cavities of sternoclavicular joint
Subclavius muscle
Costoclavicular ligament
Costoclavicular ligament
Synchondrosis of 1st rib
1st rib
Manubrium
Costal cartilages
Sternocostal (synovial) joint
2nd rib
Radiate sternocostal ligament
Manubriosternal synchondrosis

Humerus and Scapula: Anterior Views

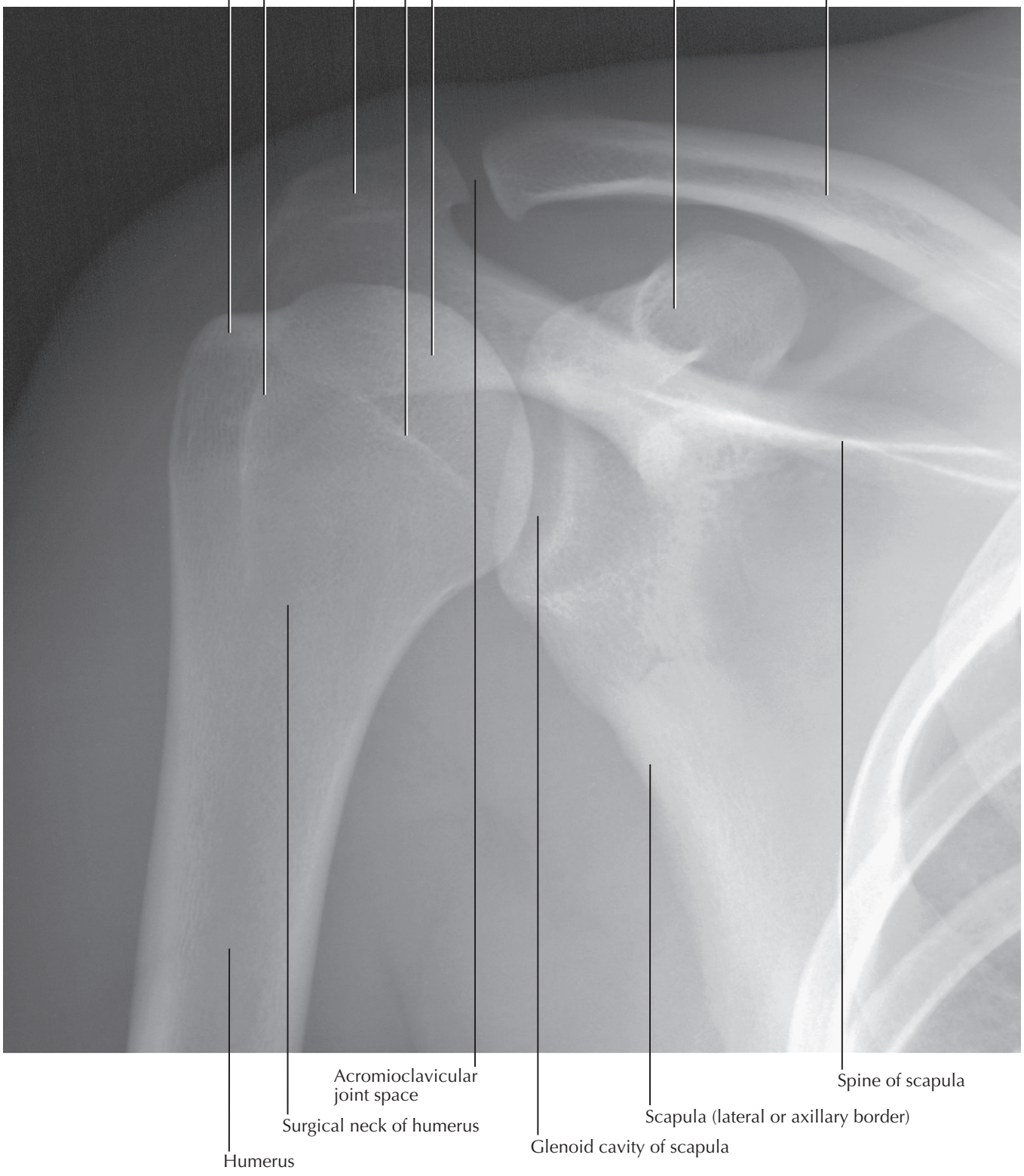
See also Plates 183, 407, 422

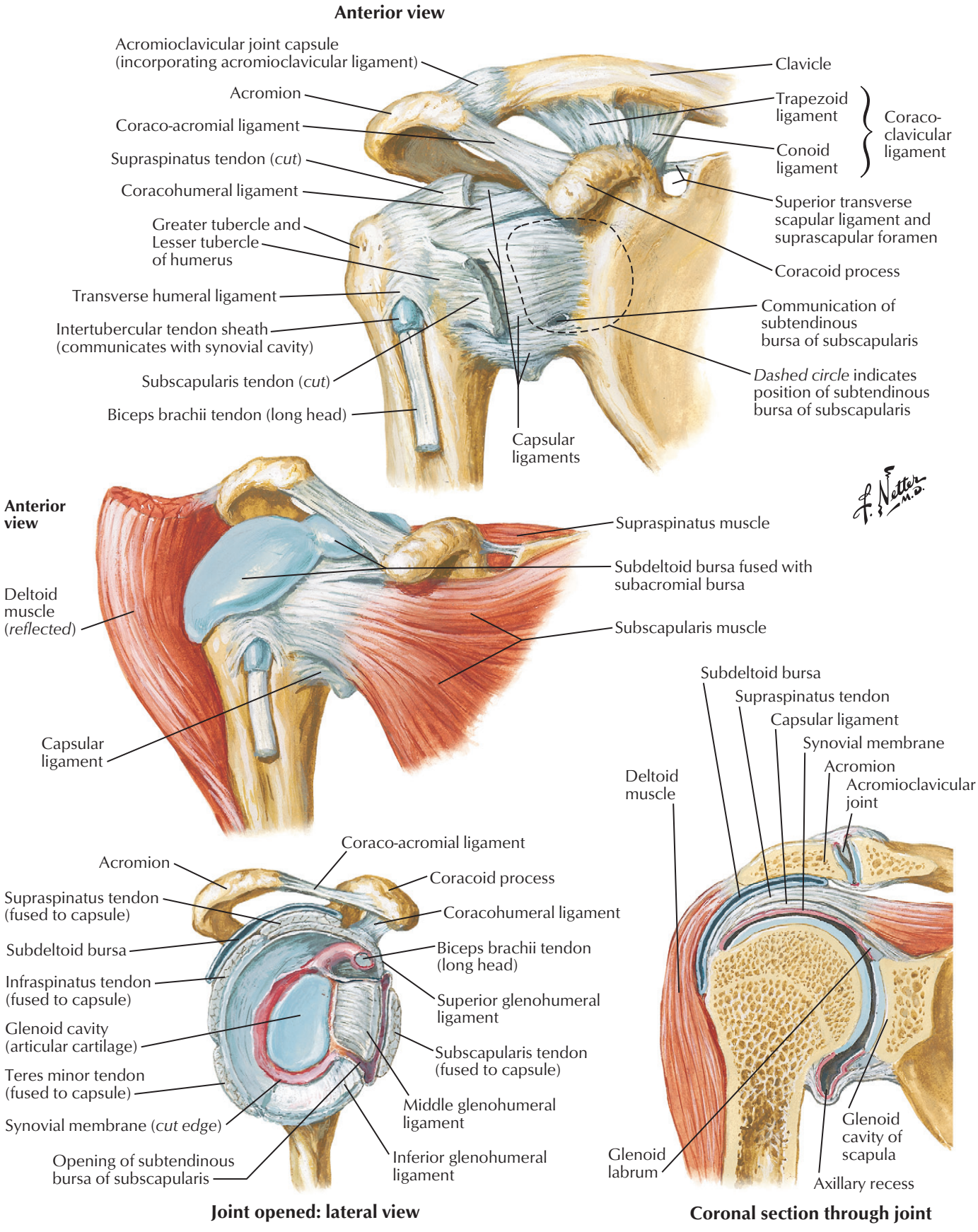



Suprascapular notch
Clavicle (cut)
Superior border
Coracoid process
Superior angle
Acromion
Acromial angle
Supraspinous fossa
Notch connecting supraspinous and infraspinous fossae
Spine
Neck
Greater tubercle
Infraspinous fossa
Head of humerus
Medial border
Anatomical neck
Lateral border
Surgical neck
Groove for circumflex scapular vessels
Infraglenoid tubercle
Inferior angle
Deltoid tuberosity
Scapula
Humerus
Radial groove
Supraspinatus muscle
Trapezius muscle
Levator scapulae muscle
Deltoid muscle
Medial supracondylar ridge
Supraspinatus muscle
Lateral supracondylar ridge
Rhomboid minor muscle
Infraspinatus muscle
Olecranon fossa
Teres minor muscle
Rhomboid major muscle
Triceps brachii muscle (lateral head)
Lateral epicondyle
Triceps brachii muscle (long head)
Trochlea
Infraspinatus muscle
Deltoid muscle
Groove for ulnar nerve
Teres minor muscle
Brachialis muscle
Medial epicondyle
Latissimus dorsi muscle (small slip of origin)
Teres major muscle
Triceps brachii muscle (medial head)
Muscle attachments
Origins
Insertions
Triceps brachii muscle
Common extensor tendon
Common flexor tendon
Anconeus muscle

Shoulder: Anteroposterior Radiograph

See also **Plate 405**



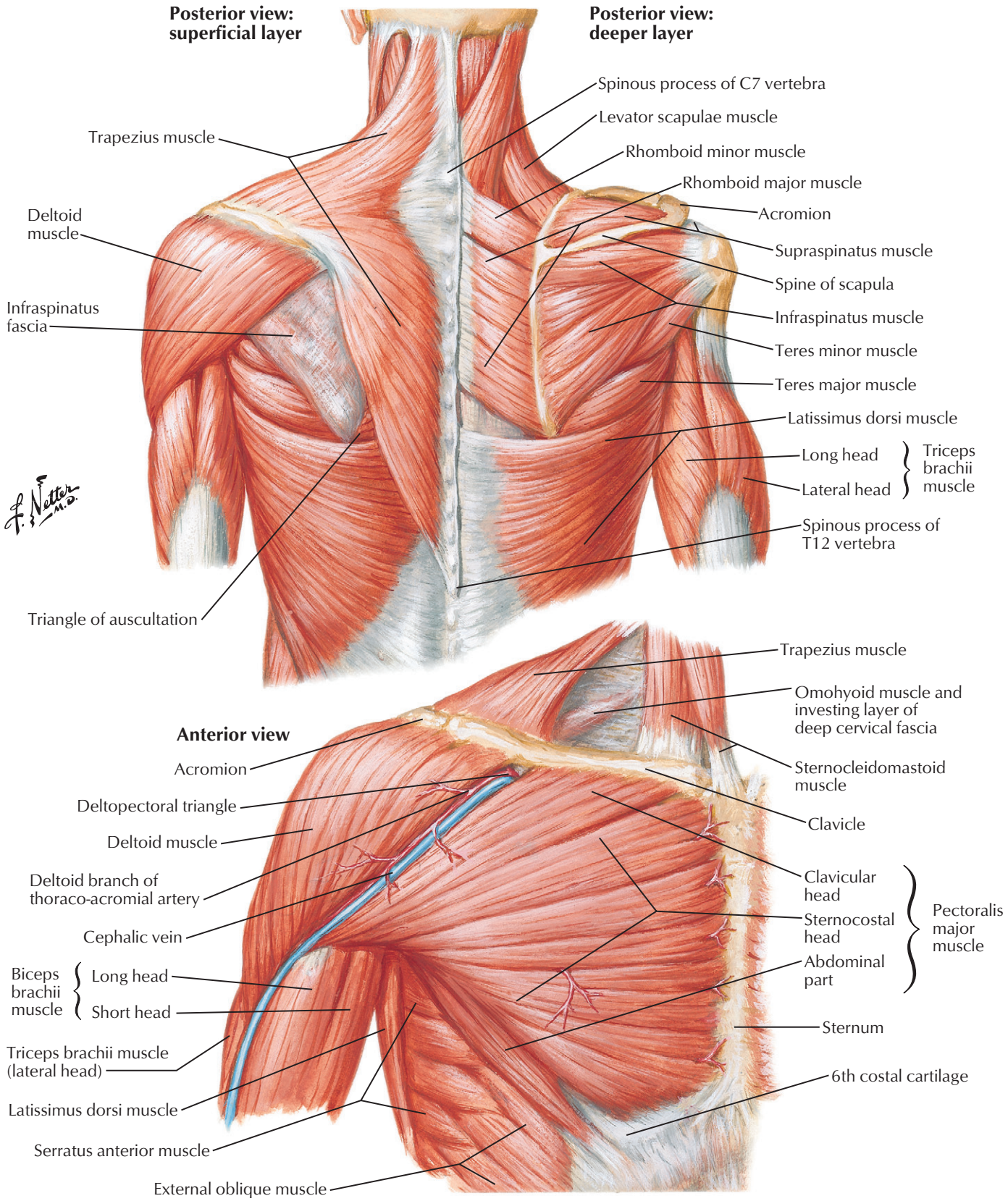


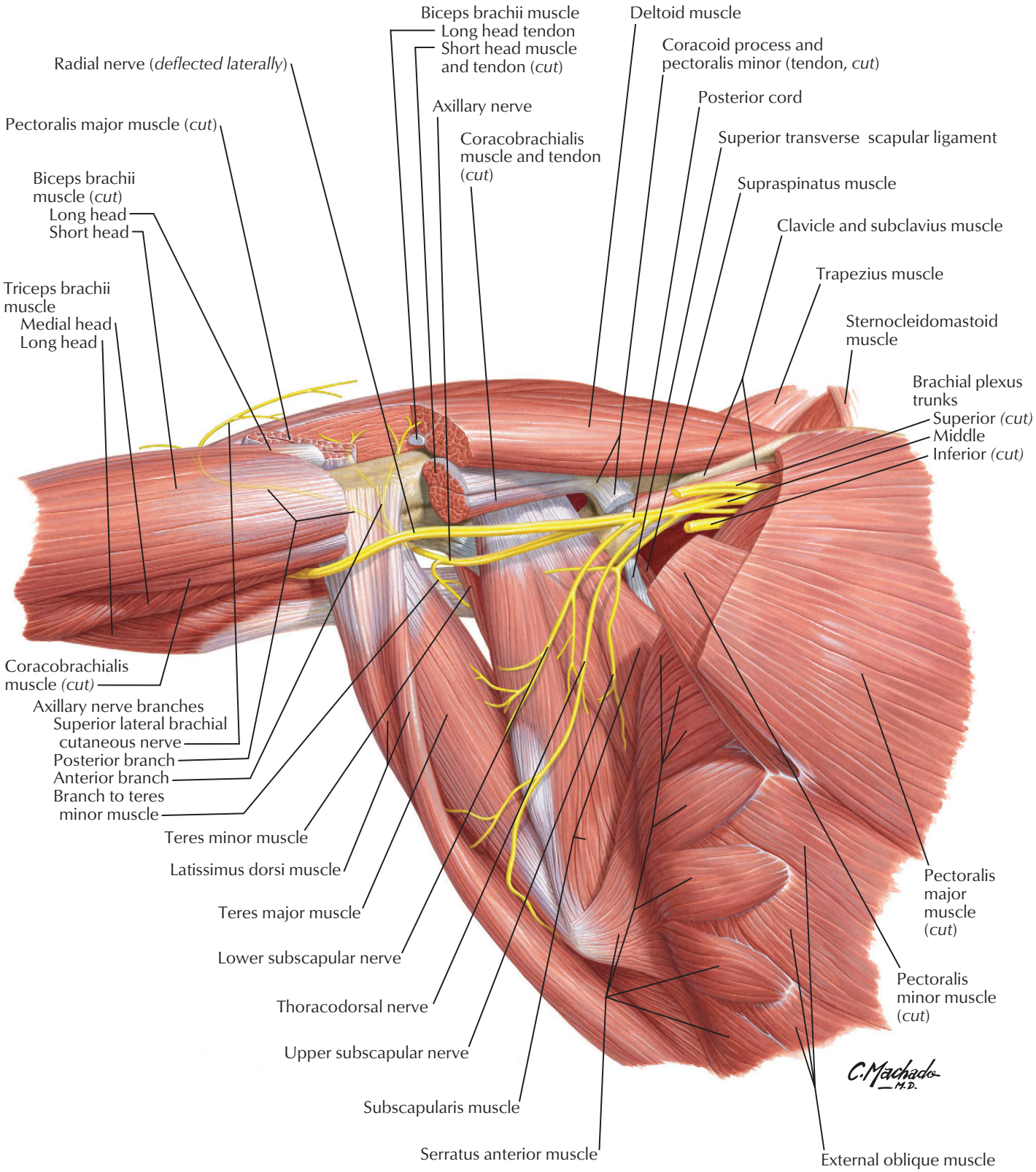
Joint opened: lateral view

Coronal section through joint

Muscles of Shoulder

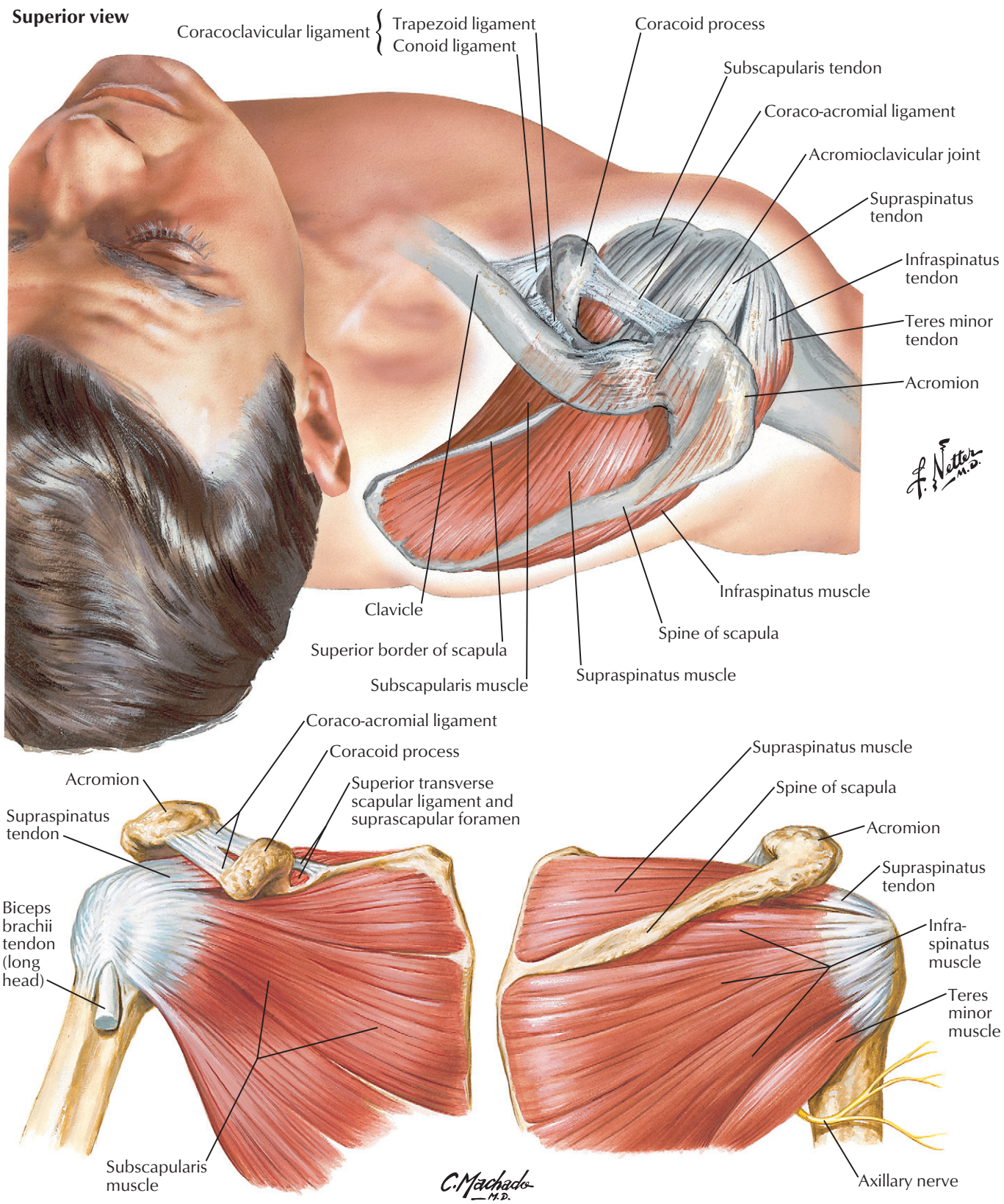
See also Plates 29, 171, 185

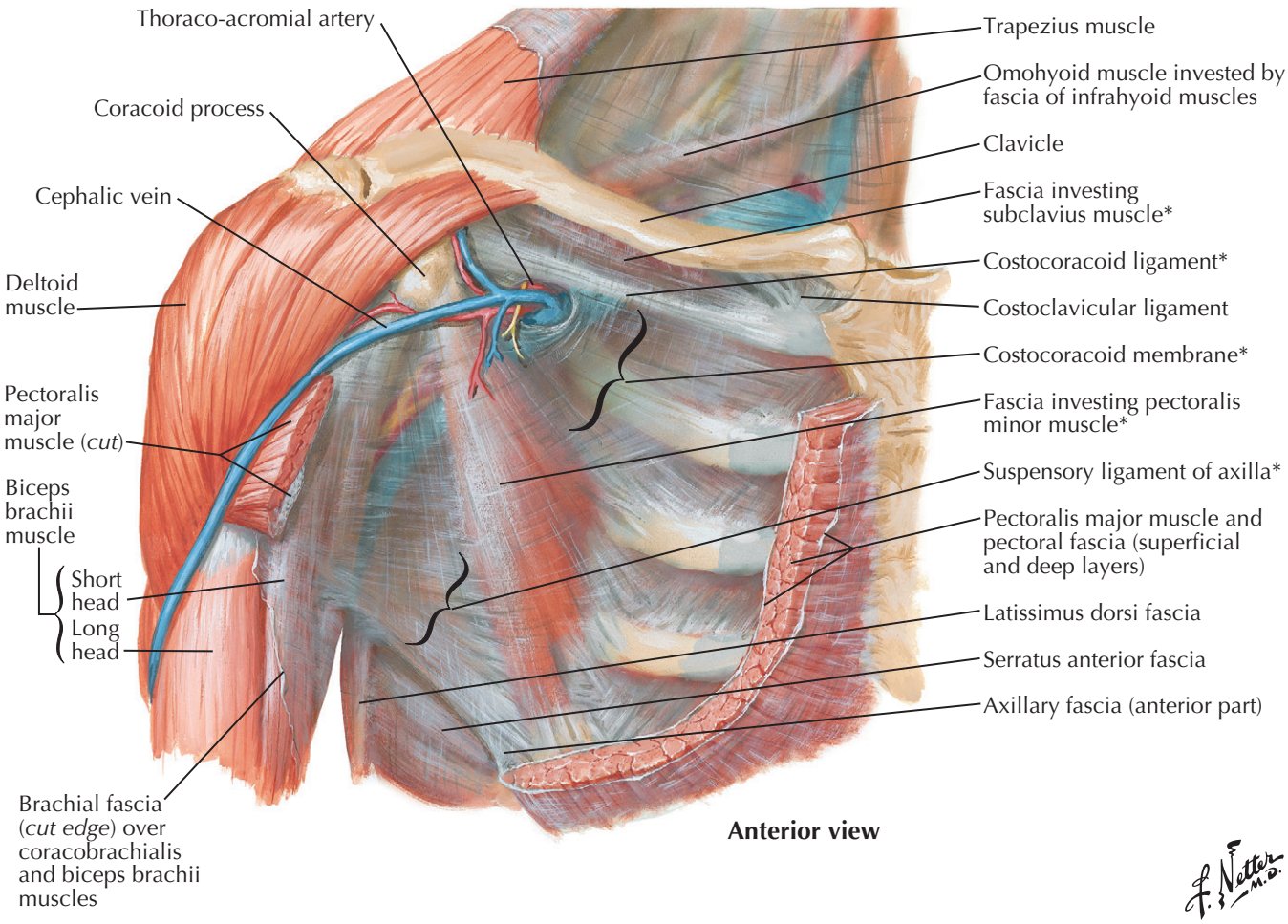



Biceps brachii muscle
Long head tendon
Short head muscle and tendon (cut)
Deltoid muscle
Radial nerve (deflected laterally)
Coracoid process and pectoralis minor (tendon, cut)
Axillary nerve
Posterior cord
Pectoralis major muscle (cut)
Coracobrachialis muscle and tendon (cut)
Superior transverse scapular ligament
Biceps brachii muscle (cut)
Long head
Short head
Supraspinatus muscle
Clavicle and subclavius muscle
Trapezius muscle
Triceps brachii muscle
Medial head
Long head
Sternocleidomastoid muscle
Brachial plexus trunks
Superior (cut)
Middle
Inferior (cut)
Coracobrachialis muscle (cut)
Axillary nerve branches
Superior lateral brachial cutaneous nerve
Posterior branch
Anterior branch
Branch to teres minor muscle
Teres minor muscle
Latissimus dorsi muscle
Teres major muscle
Lower subscapular nerve
Thoracodorsal nerve
Upper subscapular nerve
Subscapularis muscle
Serratus anterior muscle
Pectoralis major muscle (cut)
Pectoralis minor muscle (cut)
External oblique muscle
C. Machado M.D.

Muscles of Rotator Cuff

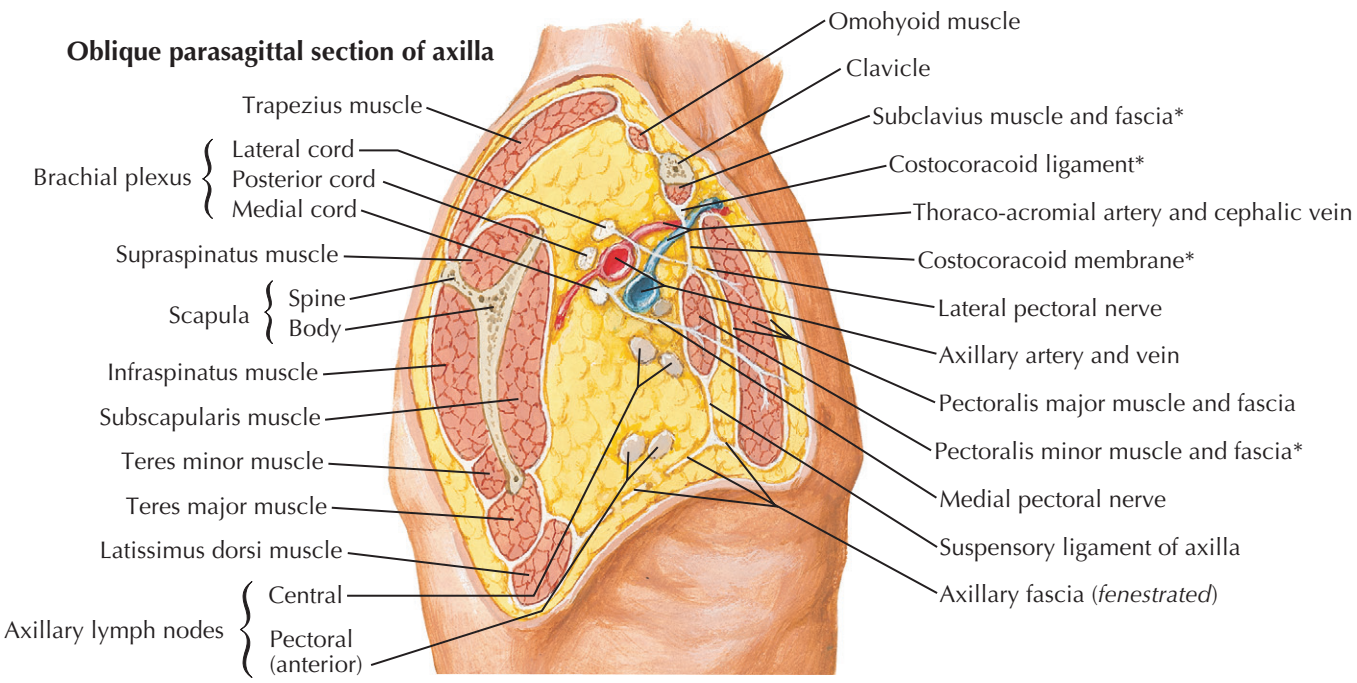
See also Plates 408, 417, 418





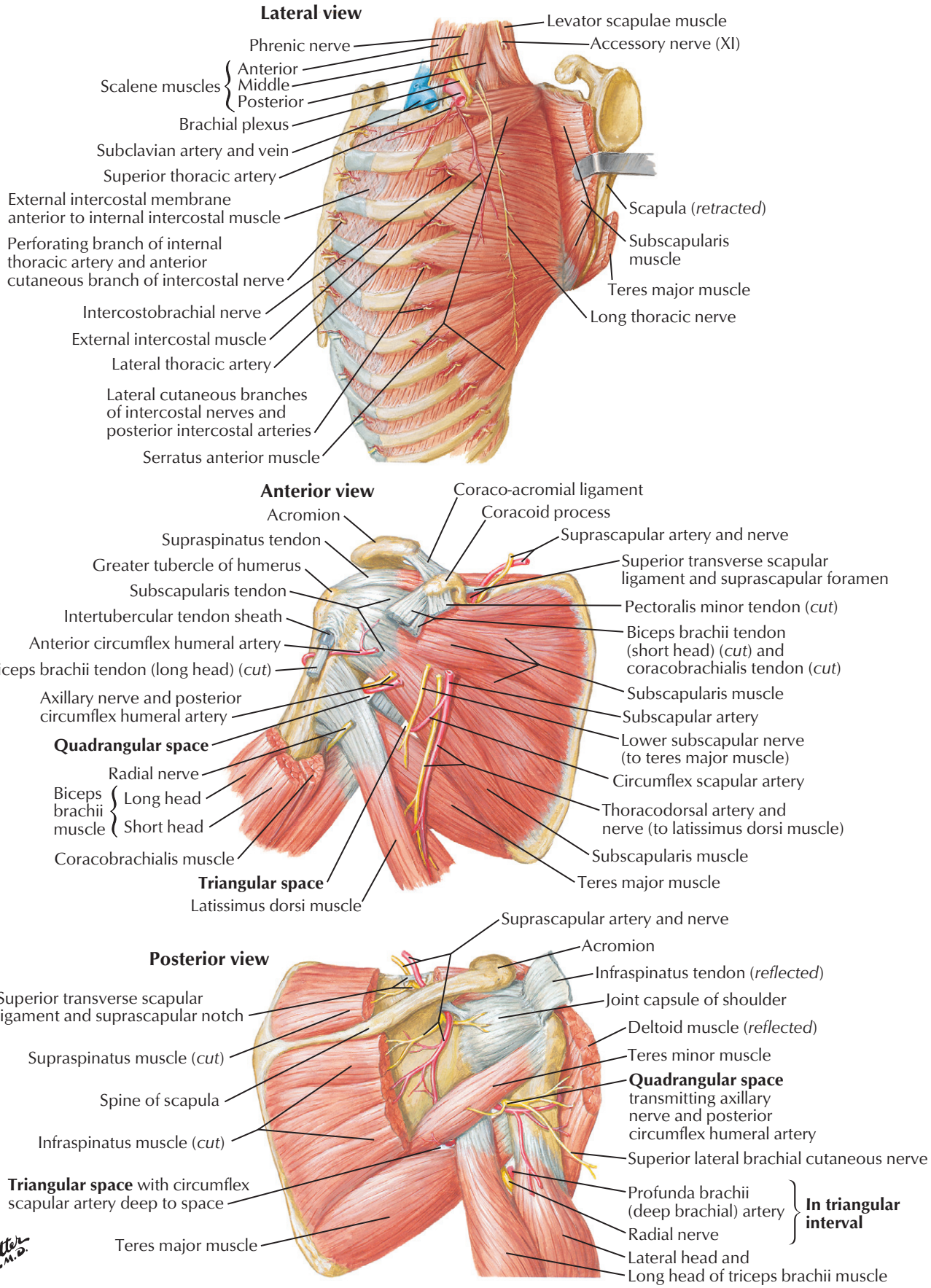
Anterior view

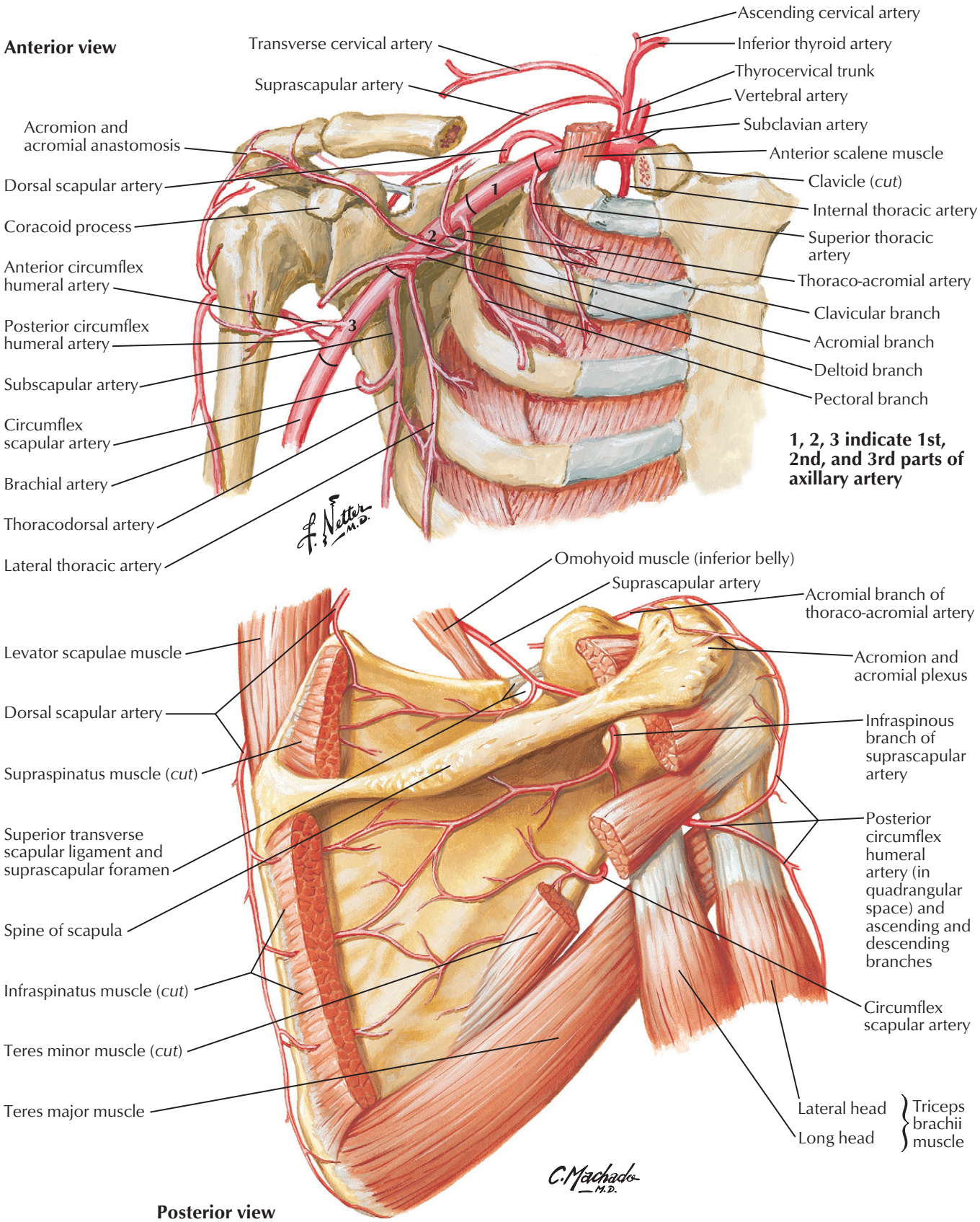
Oblique parasagittal section of axilla



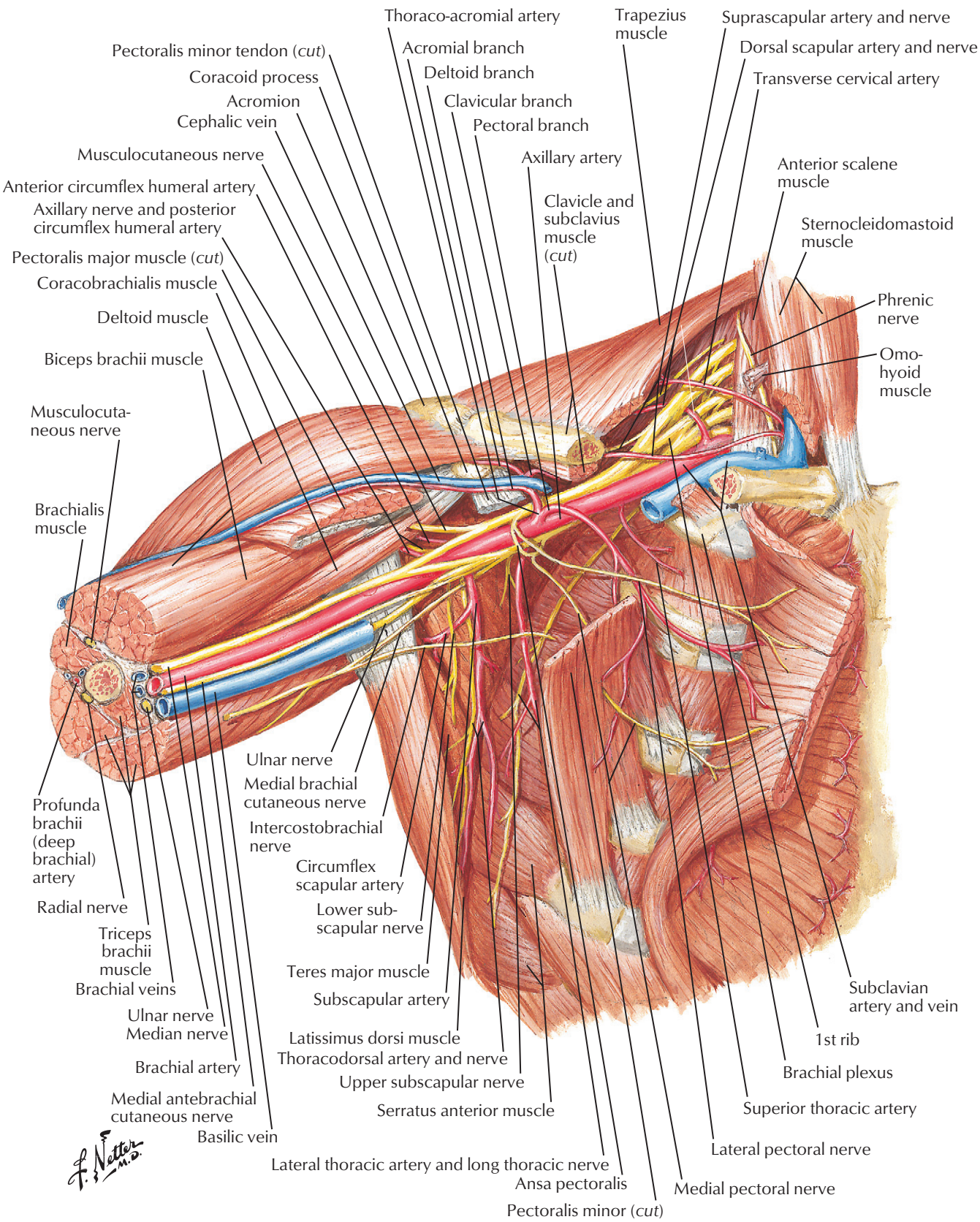
*Components of clavipectoral fascia

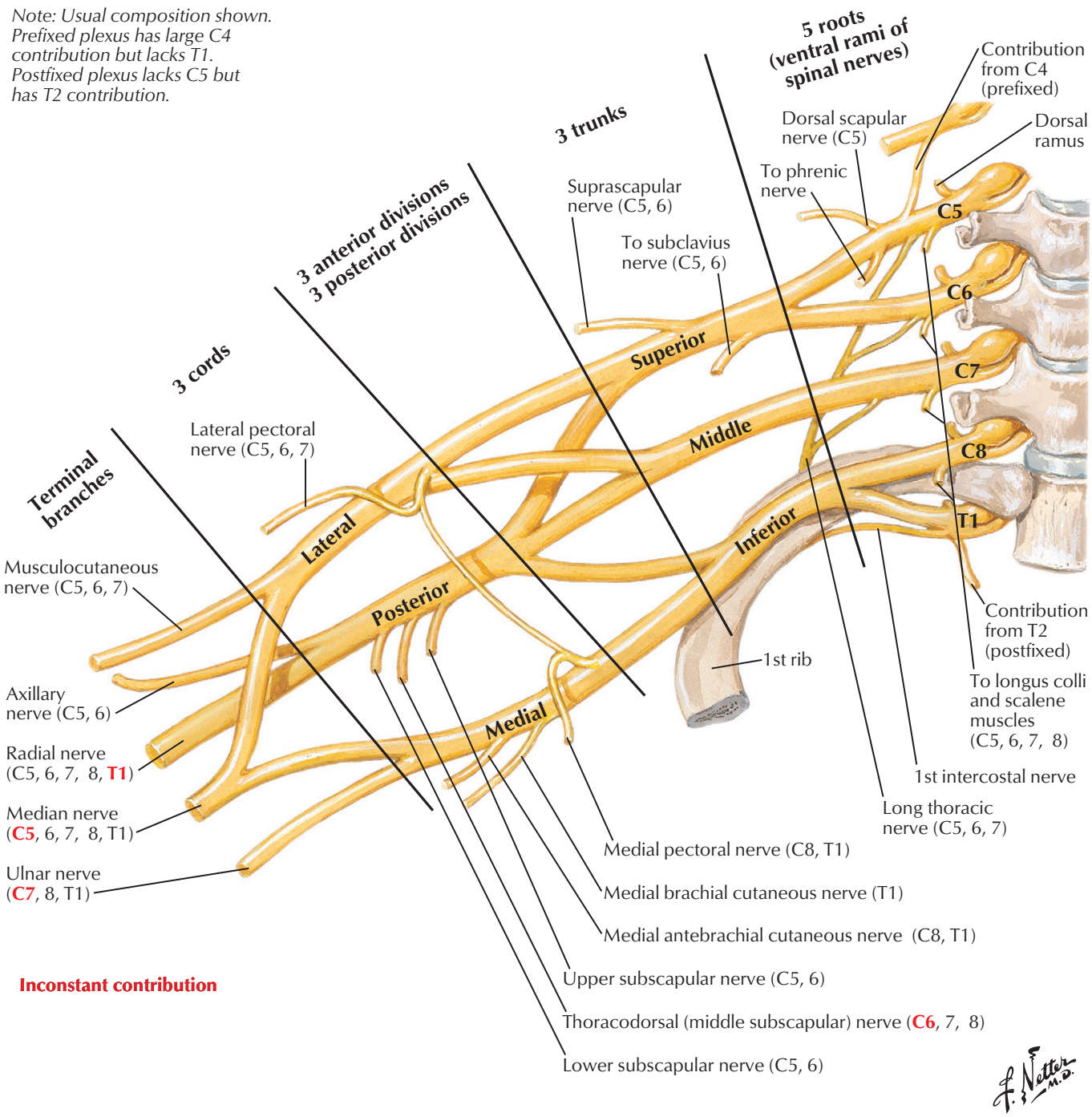
See also Plates 415, 465




Anterior view
Transverse cervical artery
Suprascapular artery
Acromion and acromial anastomosis
Dorsal scapular artery
Coracoid process
Anterior circumflex humeral artery
Posterior circumflex humeral artery
Subscapular artery
Circumflex scapular artery
Brachial artery
Thoracodorsal artery
Lateral thoracic artery
Ascending cervical artery
Inferior thyroid artery
Thyrocervical trunk
Vertebral artery
Subclavian artery
Anterior scalene muscle
Clavicle (cut)
Internal thoracic artery
Superior thoracic artery
Thoraco-acromial artery
Clavicular branch
Acromial branch
Deltoid branch
Pectoral branch
1, 2, 3 indicate 1st, 2nd, and 3rd parts of axillary artery
Omohyoid muscle (inferior belly)
Suprascapular artery
Levator scapulae muscle
Dorsal scapular artery
Supraspinatus muscle (cut)
Superior transverse scapular ligament and suprascapular foramen
Spine of scapula
Infraspinatus muscle (cut)
Teres minor muscle (cut)
Teres major muscle
Acromial branch of thoraco-acromial artery
Acromion and acromial plexus
Infraspinous branch of suprascapular artery
Posterior circumflex humeral artery (in quadrangular space) and ascending and descending branches
Circumflex scapular artery
Lateral head
Long head
Triceps brachii muscle
Posterior view

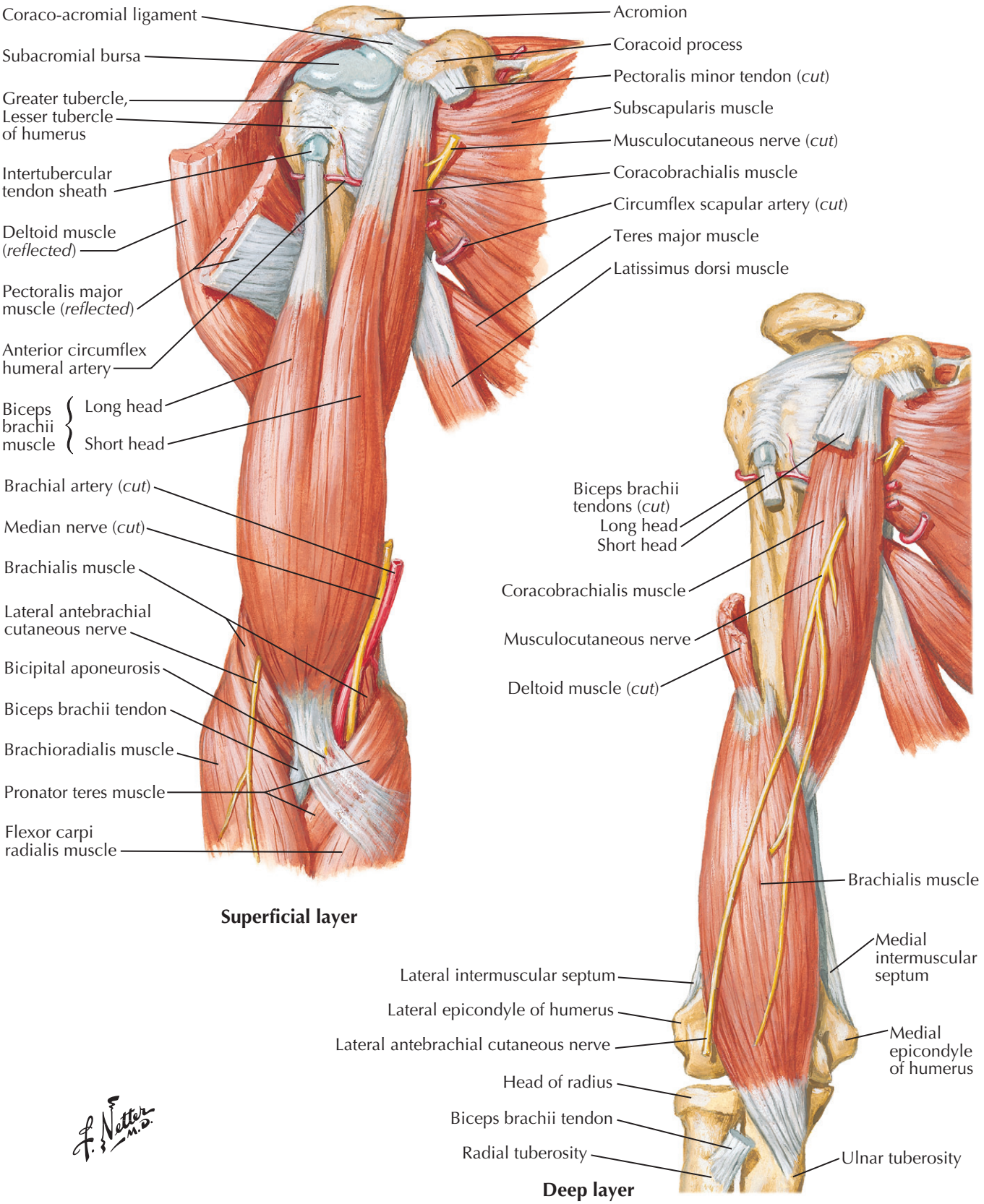
See also Plates 410, 413




Note: Usual composition shown. Prefixed plexus has large C4 contribution but lacks T1. Postfixed plexus lacks C5 but has T2 contribution.
5 roots (ventral rami of spinal nerves)
3 trunks
3 anterior divisions
3 posterior divisions
3 cords
Terminal branches
Contribution from C4 (prefixed)
Dorsal scapular nerve (C5)
Dorsal ramus
To phrenic nerve
Suprascapular nerve (C5, 6)
To subclavius nerve (C5, 6)
C5
C6
C7
C8
T1
Superior
Middle
Inferior
Lateral
Posterior
Medial
Lateral pectoral nerve (C5, 6, 7)
Musculocutaneous nerve (C5, 6, 7)
Axillary nerve (C5, 6)
Radial nerve (C5, 6, 7, 8, T1)
Median nerve (C5, 6, 7, 8, T1)
Ulnar nerve (C7, 8, T1)
1st rib
Contribution from T2 (postfixed)
To longus colli and scalene muscles (C5, 6, 7, 8)
1st intercostal nerve
Long thoracic nerve (C5, 6, 7)
Medial pectoral nerve (C8, T1)
Medial brachial cutaneous nerve (T1)
Medial antebrachial cutaneous nerve (C8, T1)
Upper subscapular nerve (C5, 6)
Thoracodorsal (middle subscapular) nerve (C6, 7, 8)
Lower subscapular nerve (C5, 6)
Inconstant contribution

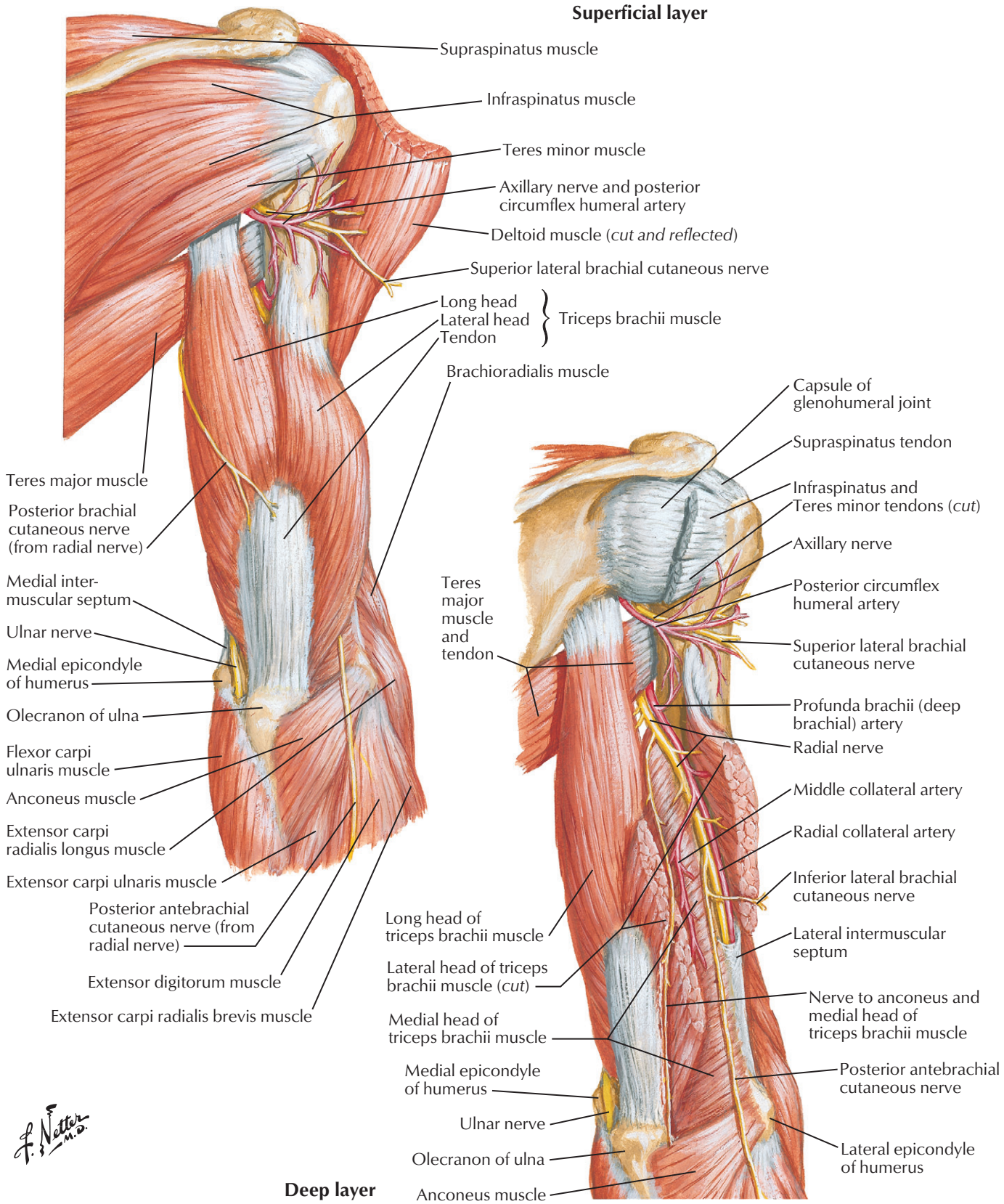
Muscles of Arm: Anterior Views

See also Plates 411, 462



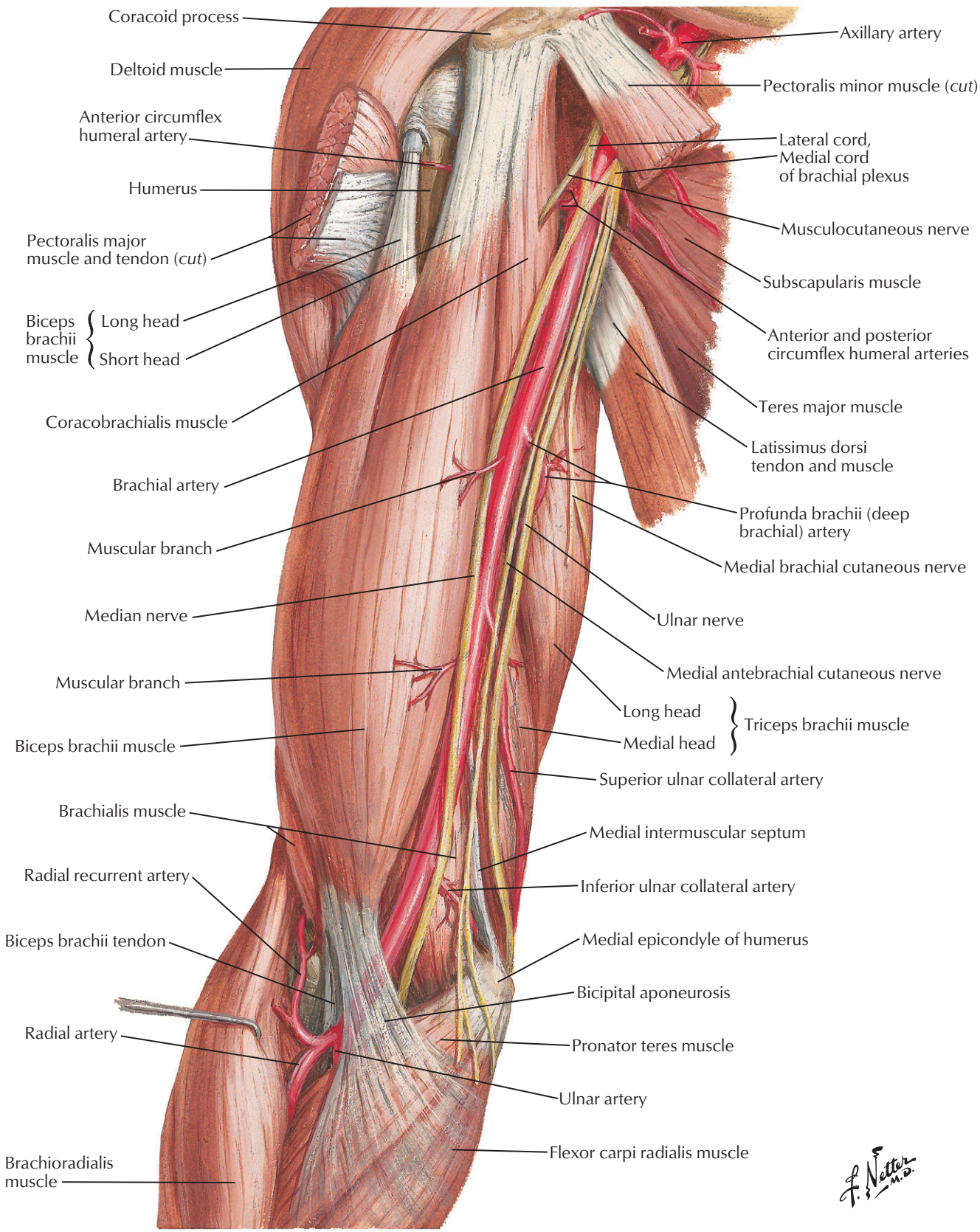
Superficial layer

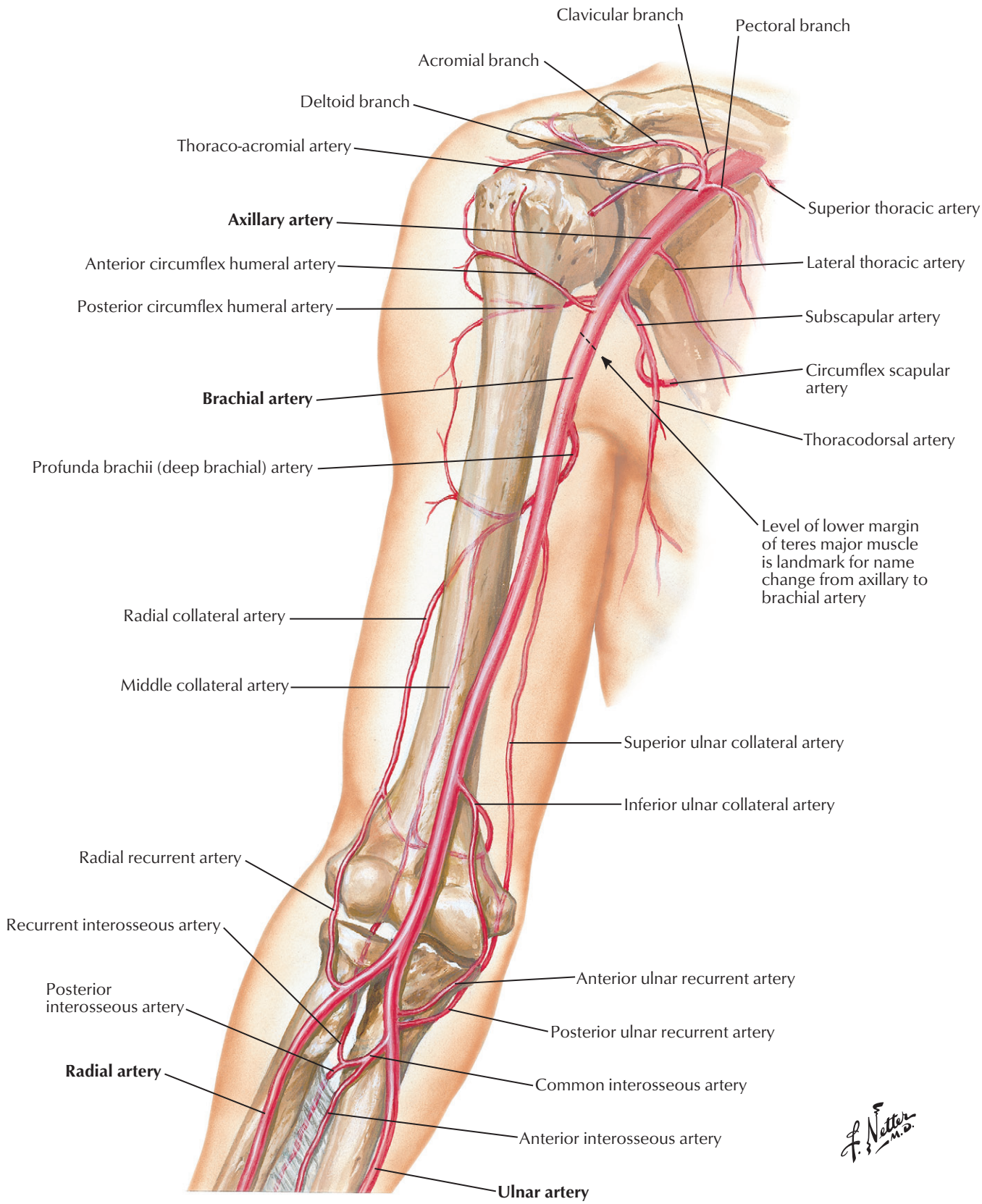
Deep layer

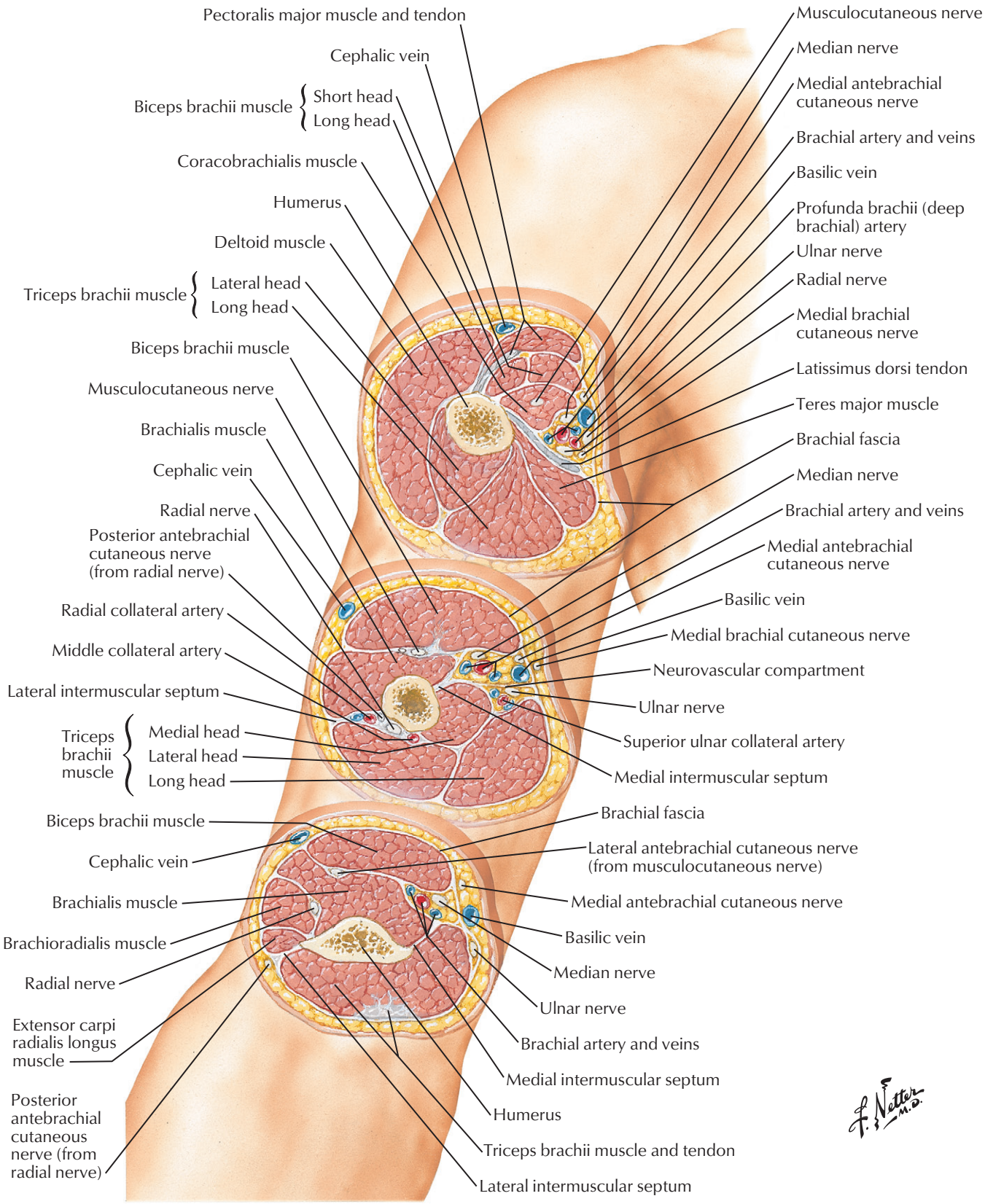

Superficial layer
Supraspinatus muscle
Infraspinatus muscle
Teres minor muscle
Axillary nerve and posterior circumflex humeral artery
Deltoid muscle (cut and reflected)
Superior lateral brachial cutaneous nerve
Long head
Lateral head
Tendon
Triceps brachii muscle
Brachioradialis muscle
Teres major muscle
Posterior brachial cutaneous nerve (from radial nerve)
Medial inter-muscular septum
Ulnar nerve
Medial epicondyle of humerus
Olecranon of ulna
Flexor carpi ulnaris muscle
Anconeus muscle
Extensor carpi radialis longus muscle
Extensor carpi ulnaris muscle
Posterior antebrachial cutaneous nerve (from radial nerve)
Extensor digitorum muscle
Extensor carpi radialis brevis muscle
Capsule of glenohumeral joint
Supraspinatus tendon
Infraspinatus and Teres minor tendons (cut)
Axillary nerve
Posterior circumflex humeral artery
Teres major muscle and tendon
Superior lateral brachial cutaneous nerve
Profunda brachii (deep brachial) artery
Radial nerve
Middle collateral artery
Radial collateral artery
Inferior lateral brachial cutaneous nerve
Long head of triceps brachii muscle
Lateral intermuscular septum
Lateral head of triceps brachii muscle (cut)
Nerve to anconeus and medial head of triceps brachii muscle
Medial head of triceps brachii muscle
Posterior antebrachial cutaneous nerve
Medial epicondyle of humerus
Ulnar nerve
Lateral epicondyle of humerus
Olecranon of ulna
Anconeus muscle
Deep layer

Brachial Artery in Situ

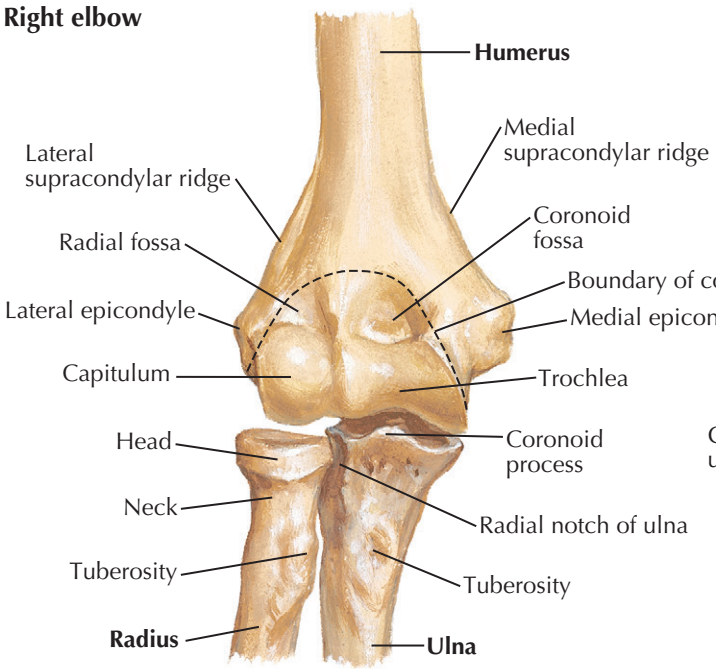
See also **Plate 401**



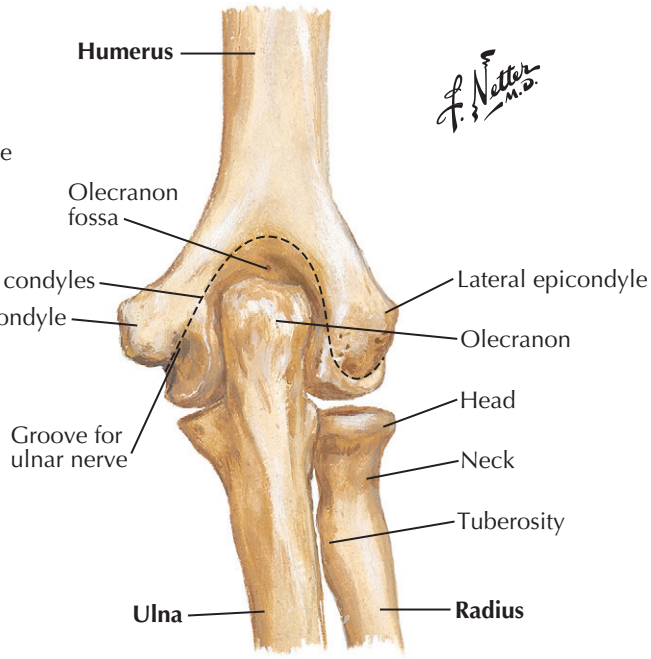

Clavicular branch
Pectoral branch
Acromial branch
Deltoid branch
Thoraco-acromial artery
Superior thoracic artery
Axillary artery
Anterior circumflex humeral artery
Lateral thoracic artery
Posterior circumflex humeral artery
Subscapular artery
Circumflex scapular artery
Brachial artery
Thoracodorsal artery
Profunda brachii (deep brachial) artery
Level of lower margin of teres major muscle is landmark for name change from axillary to brachial artery
Radial collateral artery
Middle collateral artery
Superior ulnar collateral artery
Inferior ulnar collateral artery
Radial recurrent artery
Recurrent interosseous artery
Anterior ulnar recurrent artery
Posterior interosseous artery
Posterior ulnar recurrent artery
Radial artery
Common interosseous artery
Anterior interosseous artery
Ulnar artery


Pectoralis major muscle and tendon
Cephalic vein
Biceps brachii muscle
Short head
Long head
Coracobrachialis muscle
Humerus
Deltoid muscle
Triceps brachii muscle
Lateral head
Long head
Biceps brachii muscle
Musculocutaneous nerve
Brachialis muscle
Cephalic vein
Radial nerve
Posterior antebrachial cutaneous nerve (from radial nerve)
Radial collateral artery
Middle collateral artery
Lateral intermuscular septum
Triceps brachii muscle
Medial head
Lateral head
Long head
Biceps brachii muscle
Cephalic vein
Brachialis muscle
Brachioradialis muscle
Radial nerve
Extensor carpi radialis longus muscle
Posterior antebrachial cutaneous nerve (from radial nerve)
Musculocutaneous nerve
Median nerve
Medial antebrachial cutaneous nerve
Brachial artery and veins
Basilic vein
Profunda brachii (deep brachial) artery
Ulnar nerve
Radial nerve
Medial brachial cutaneous nerve
Latissimus dorsi tendon
Teres major muscle
Brachial fascia
Median nerve
Brachial artery and veins
Medial antebrachial cutaneous nerve
Basilic vein
Medial brachial cutaneous nerve
Neurovascular compartment
Ulnar nerve
Superior ulnar collateral artery
Medial intermuscular septum
Brachial fascia
Lateral antebrachial cutaneous nerve (from musculocutaneous nerve)
Medial antebrachial cutaneous nerve
Basilic vein
Median nerve
Ulnar nerve
Brachial artery and veins
Medial intermuscular septum
Humerus
Triceps brachii muscle and tendon
Lateral intermuscular septum

Right elbow



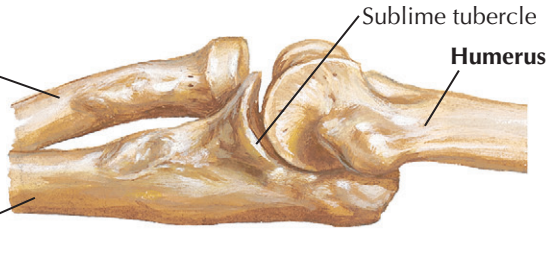
In extension: anterior view



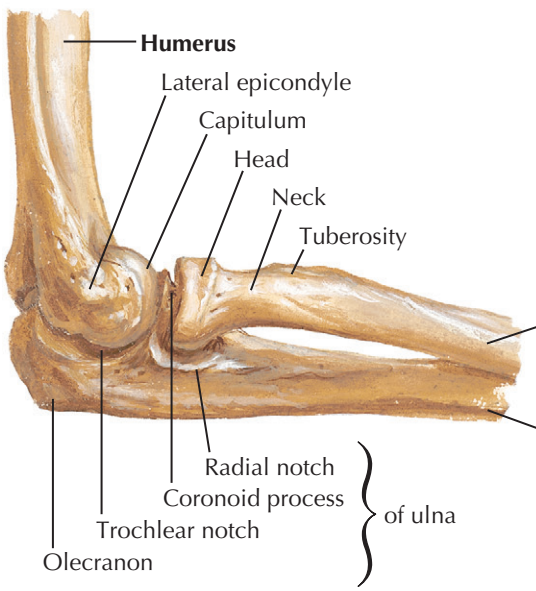
In extension: posterior view



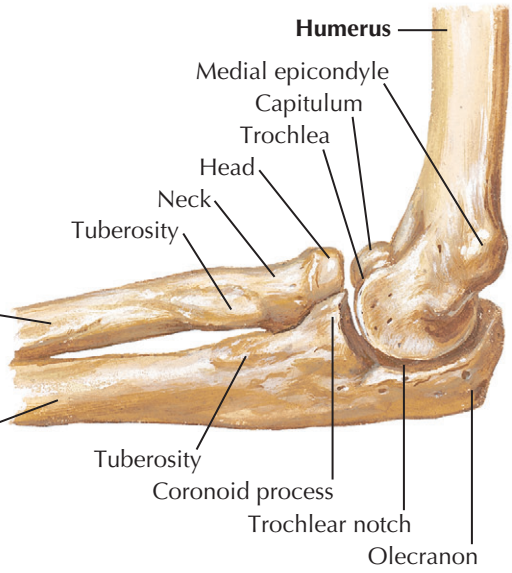
In extension: lateral view



In extension: medial view

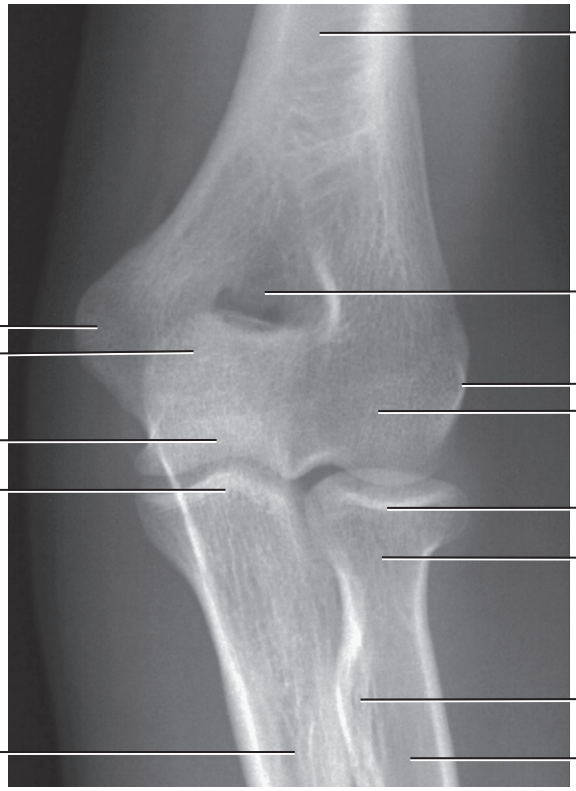


In 90° flexion: lateral view

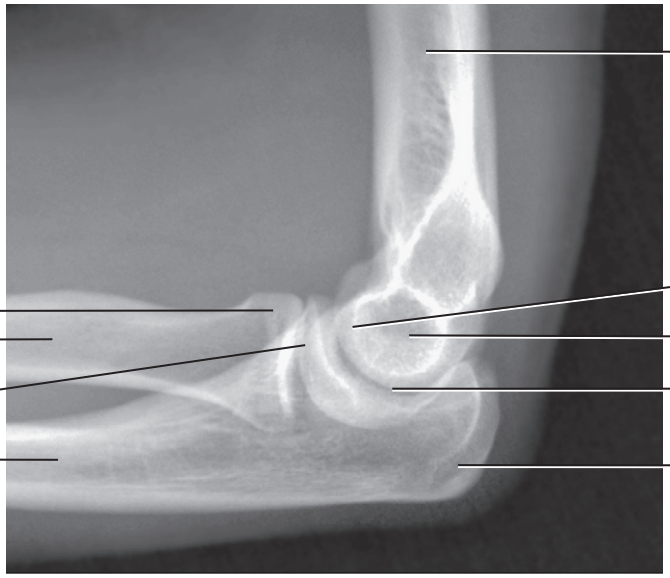


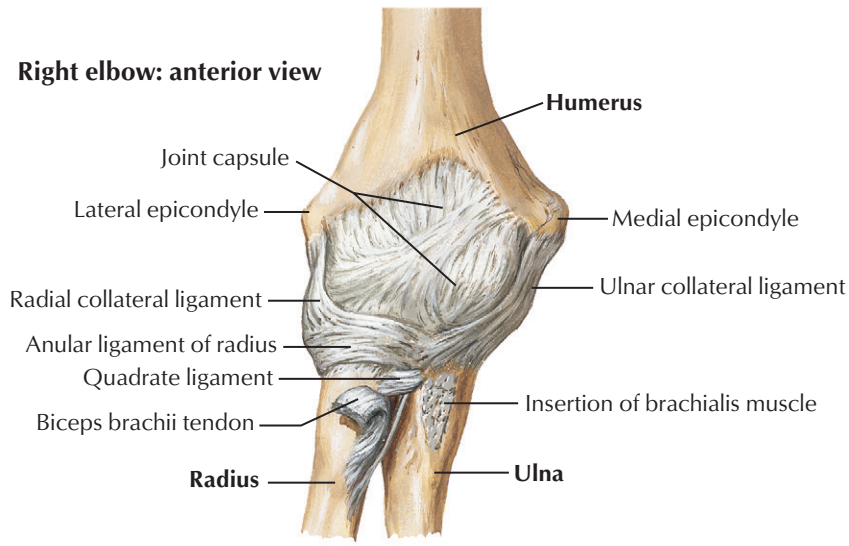
In 90° flexion: medial view

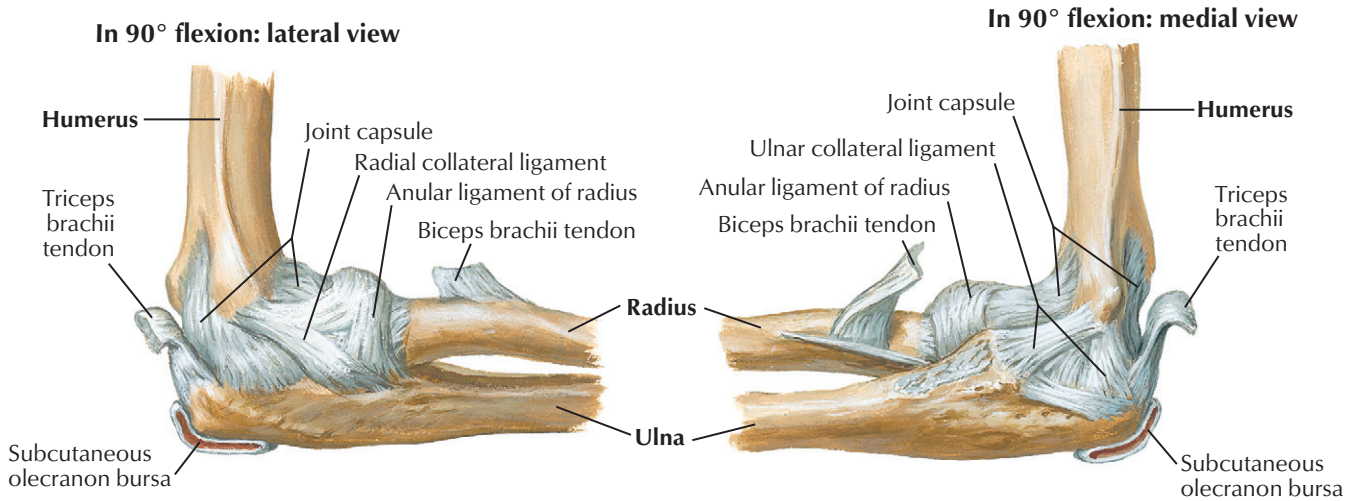
Anteroposterior radiograph

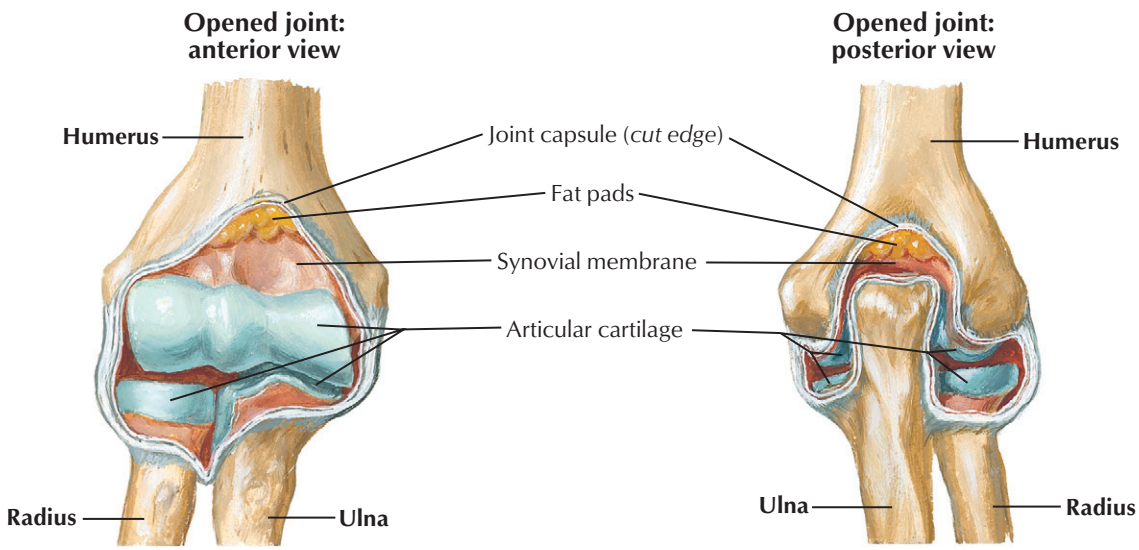


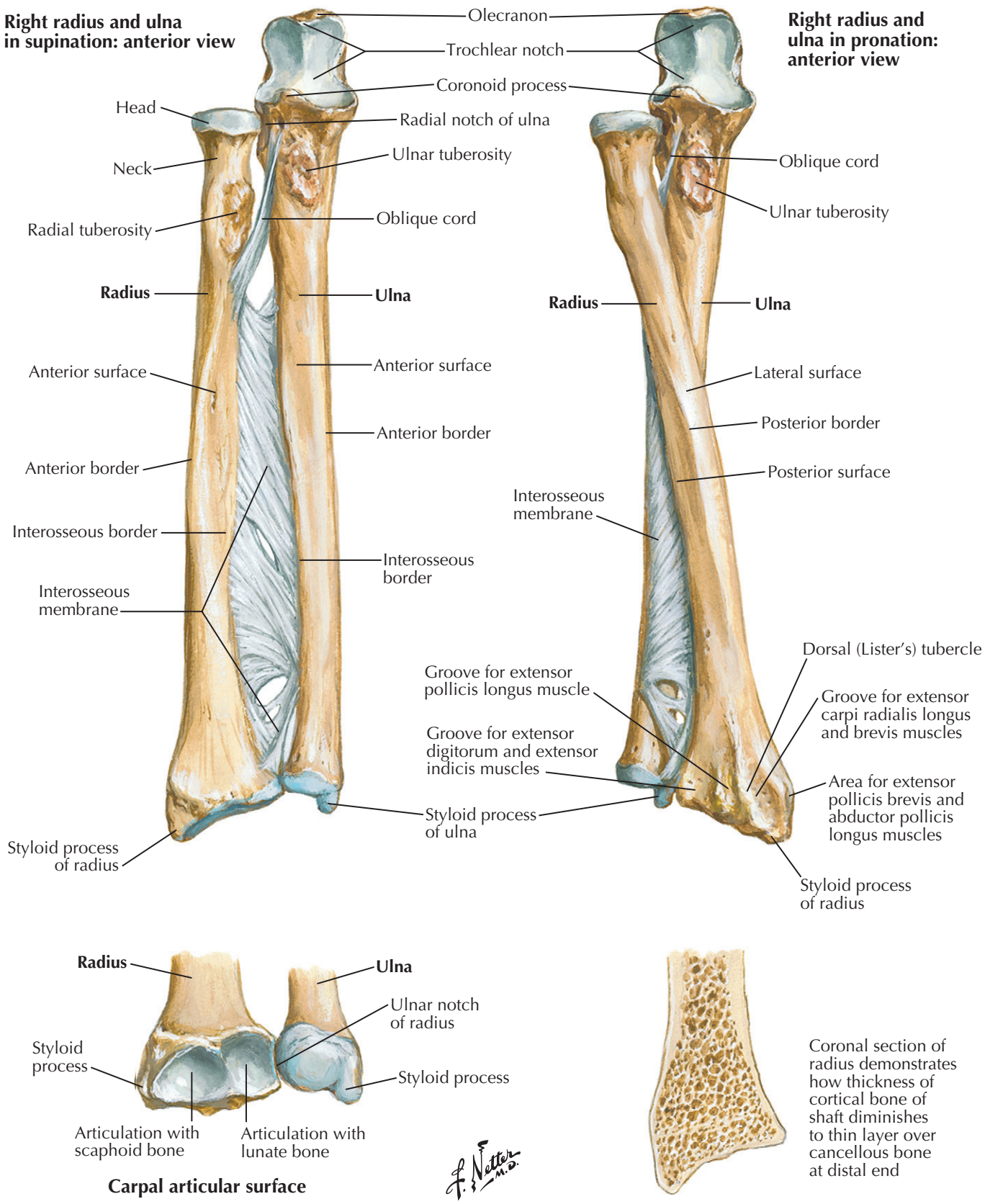
Lateral radiograph




Right elbow: anterior view
Humerus
Joint capsule
Lateral epicondyle
Medial epicondyle
Radial collateral ligament
Ulnar collateral ligament
Anular ligament of radius
Quadrate ligament
Insertion of brachialis muscle
Biceps brachii tendon
Radius
Ulna

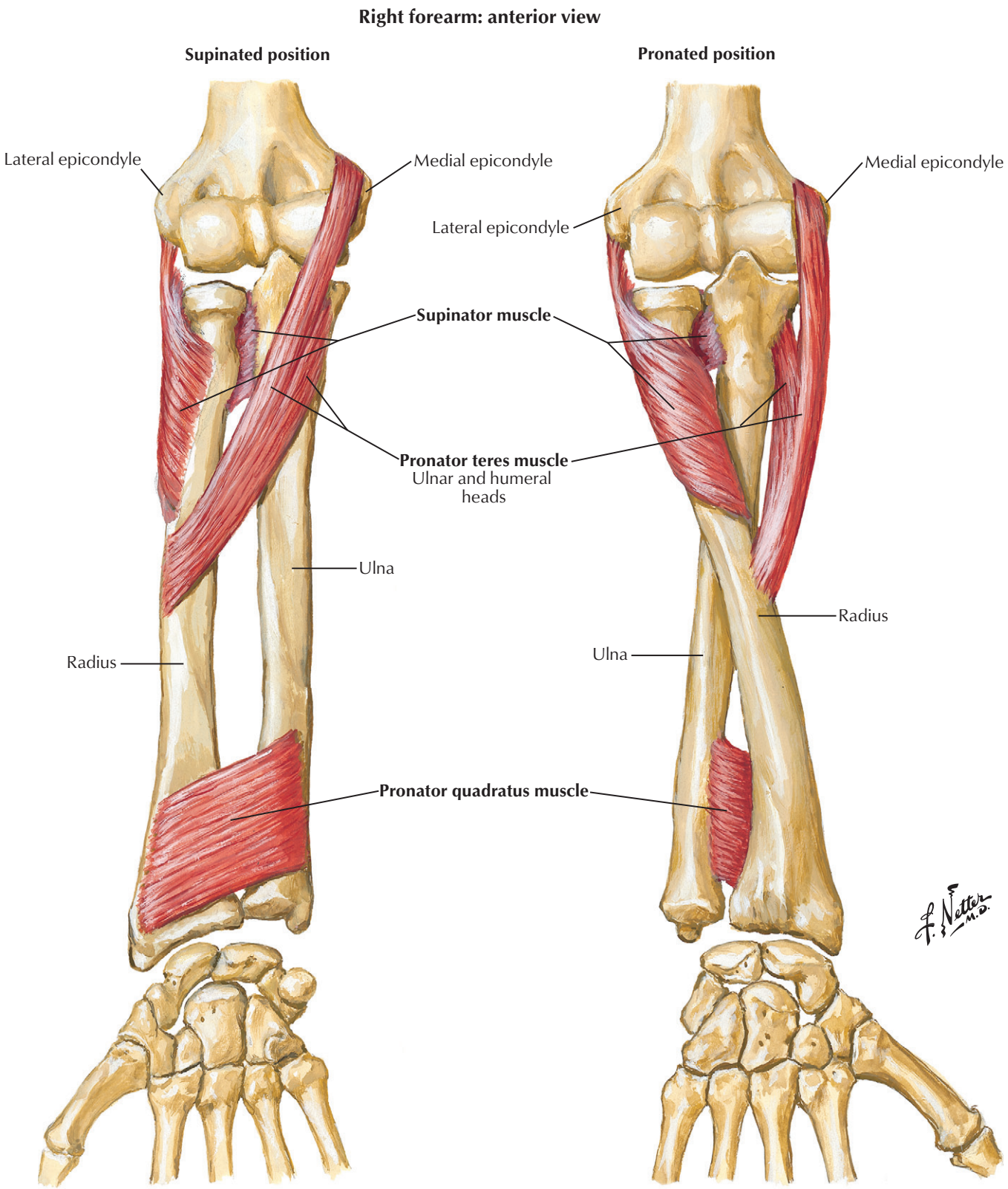

In 90° flexion: lateral view
Humerus
Joint capsule
Radial collateral ligament
Anular ligament of radius
Biceps brachii tendon
Triceps brachii tendon
Radius
Ulna
Subcutaneous olecranon bursa
In 90° flexion: medial view
Joint capsule
Humerus
Ulnar collateral ligament
Anular ligament of radius
Biceps brachii tendon
Triceps brachii tendon
Subcutaneous olecranon bursa


Opened joint: anterior view
Humerus
Joint capsule (cut edge)
Fat pads
Synovial membrane
Articular cartilage
Radius
Ulna
Opened joint: posterior view
Humerus
Ulna
Radius


Right radius and ulna in supination: anterior view
Olecranon
Trochlear notch
Coronoid process
Head
Radial notch of ulna
Neck
Ulnar tuberosity
Radial tuberosity
Oblique cord
Radius
Ulna
Anterior surface
Anterior surface
Anterior border
Anterior border
Interosseous border
Interosseous border
Interosseous membrane
Styloid process of radius
Styloid process of ulna
Right radius and ulna in pronation: anterior view
Oblique cord
Ulnar tuberosity
Radius
Ulna
Lateral surface
Posterior border
Posterior surface
Interosseous membrane
Dorsal (Lister's) tubercle
Groove for extensor pollicis longus muscle
Groove for extensor carpi radialis longus and brevis muscles
Groove for extensor digitorum and extensor indicis muscles
Area for extensor pollicis brevis and abductor pollicis longus muscles
Styloid process of radius
Radius
Ulna
Ulnar notch of radius
Styloid process
Styloid process
Articulation with scaphoid bone
Articulation with lunate bone
Carpal articular surface
Coronal section of radius demonstrates how thickness of cortical bone of shaft diminishes to thin layer over cancellous bone at distal end

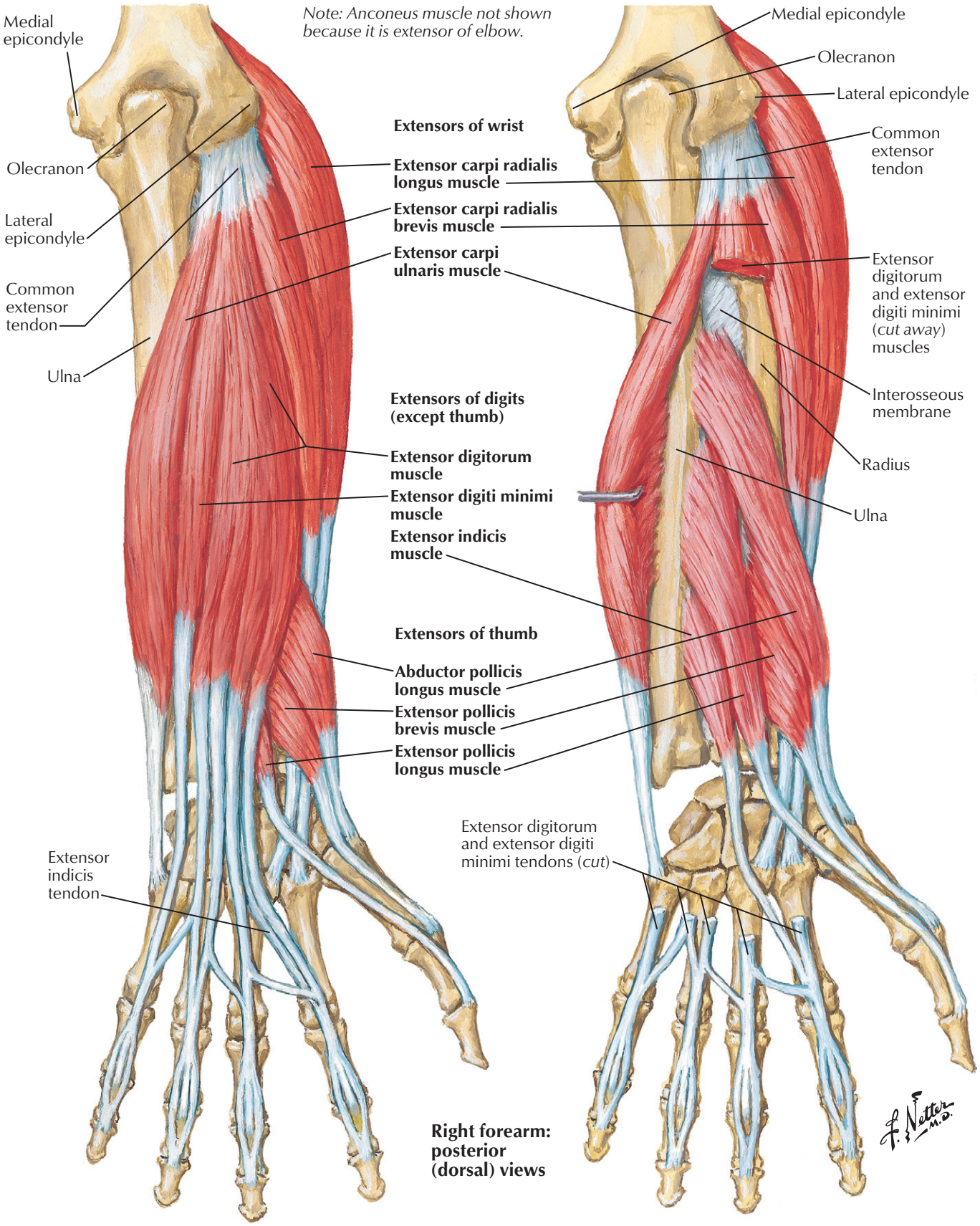
Individual Muscles of Forearm: Rotators of Radius

See also Plate 434

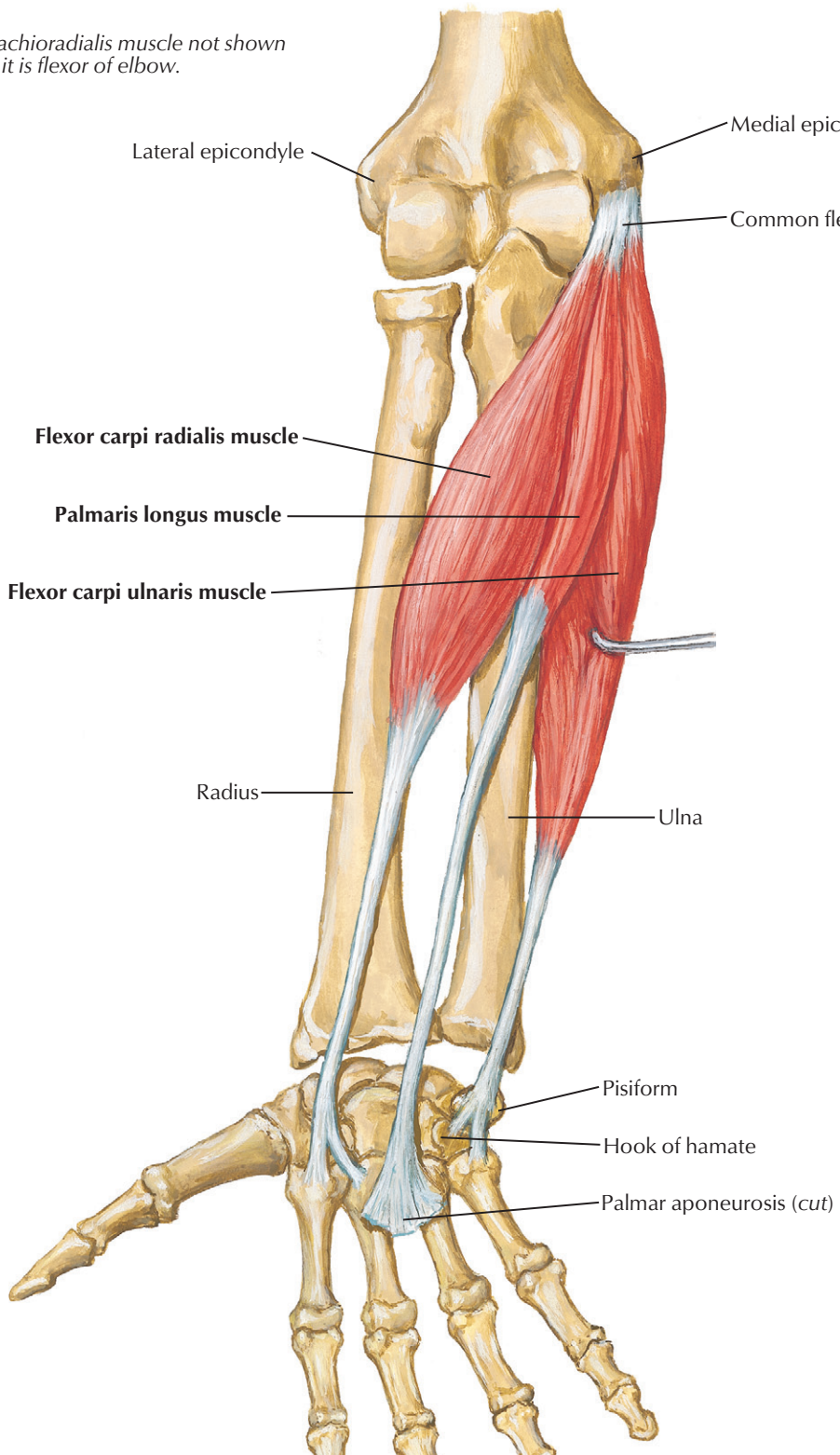


Individual Muscles of Forearm: Extensors of Wrist and Digits

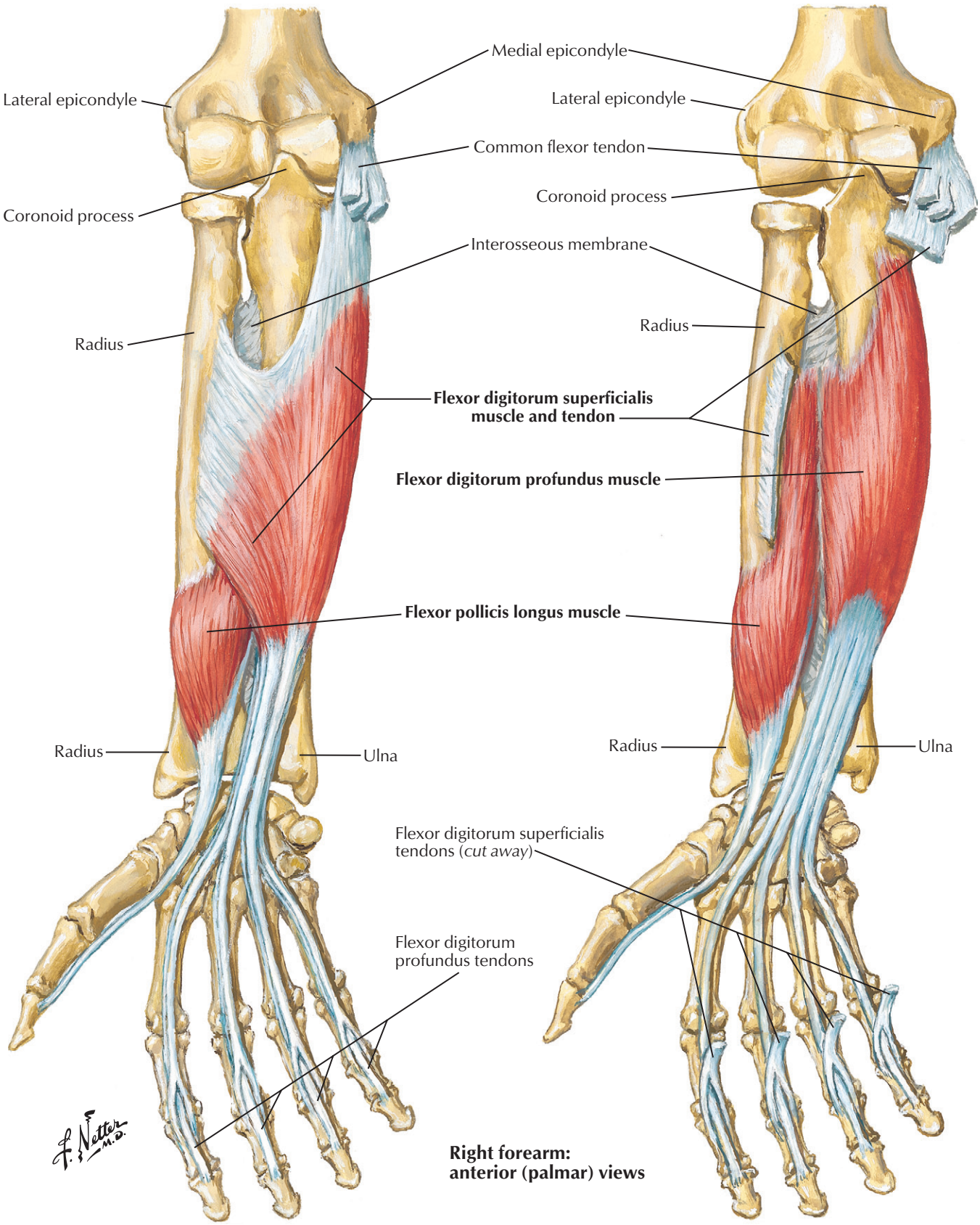
See also Plate 438



Note: Brachioradialis muscle not shown because it is flexor of elbow.



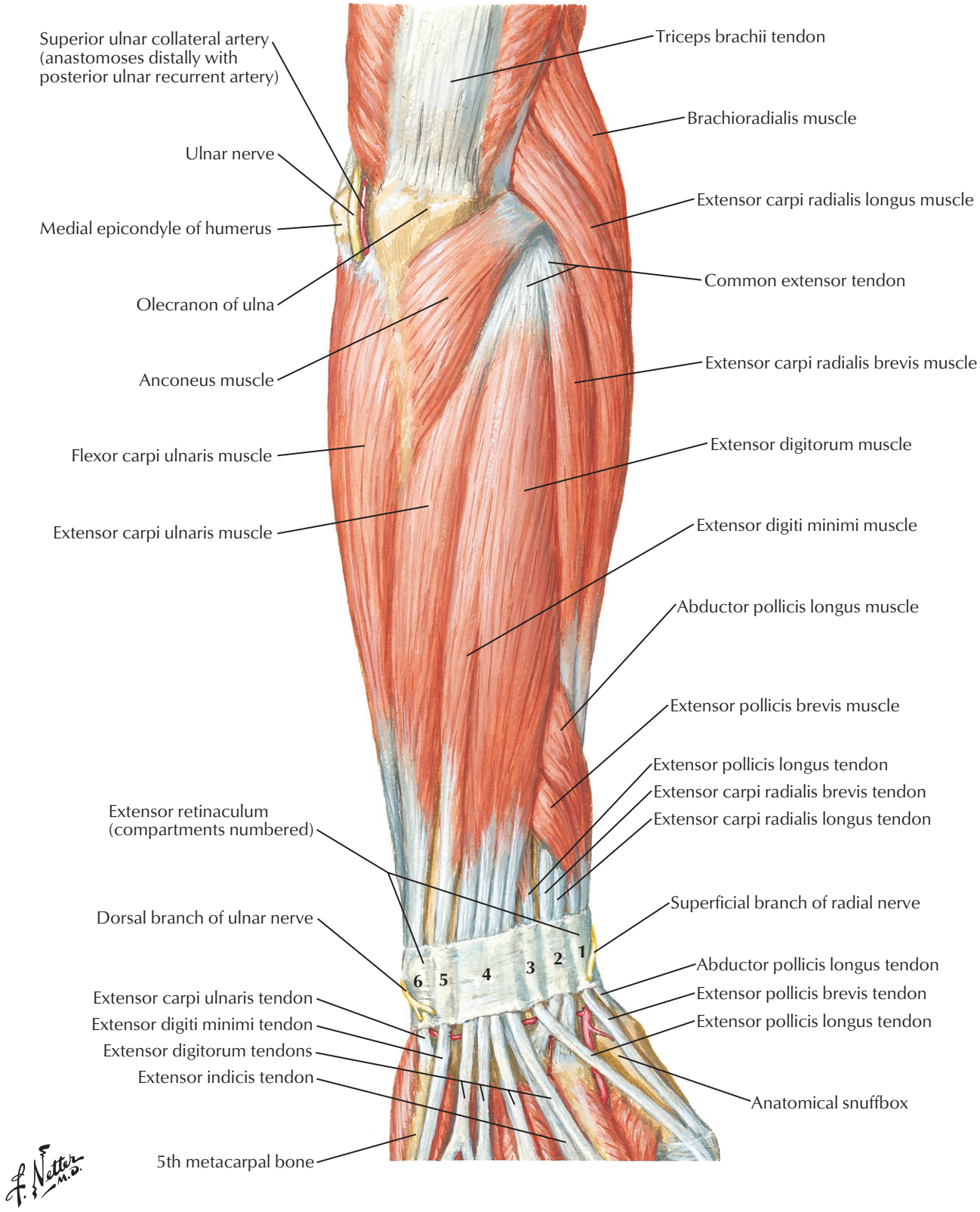
Right forearm: anterior (palmar) view



Right forearm: anterior (palmar) views

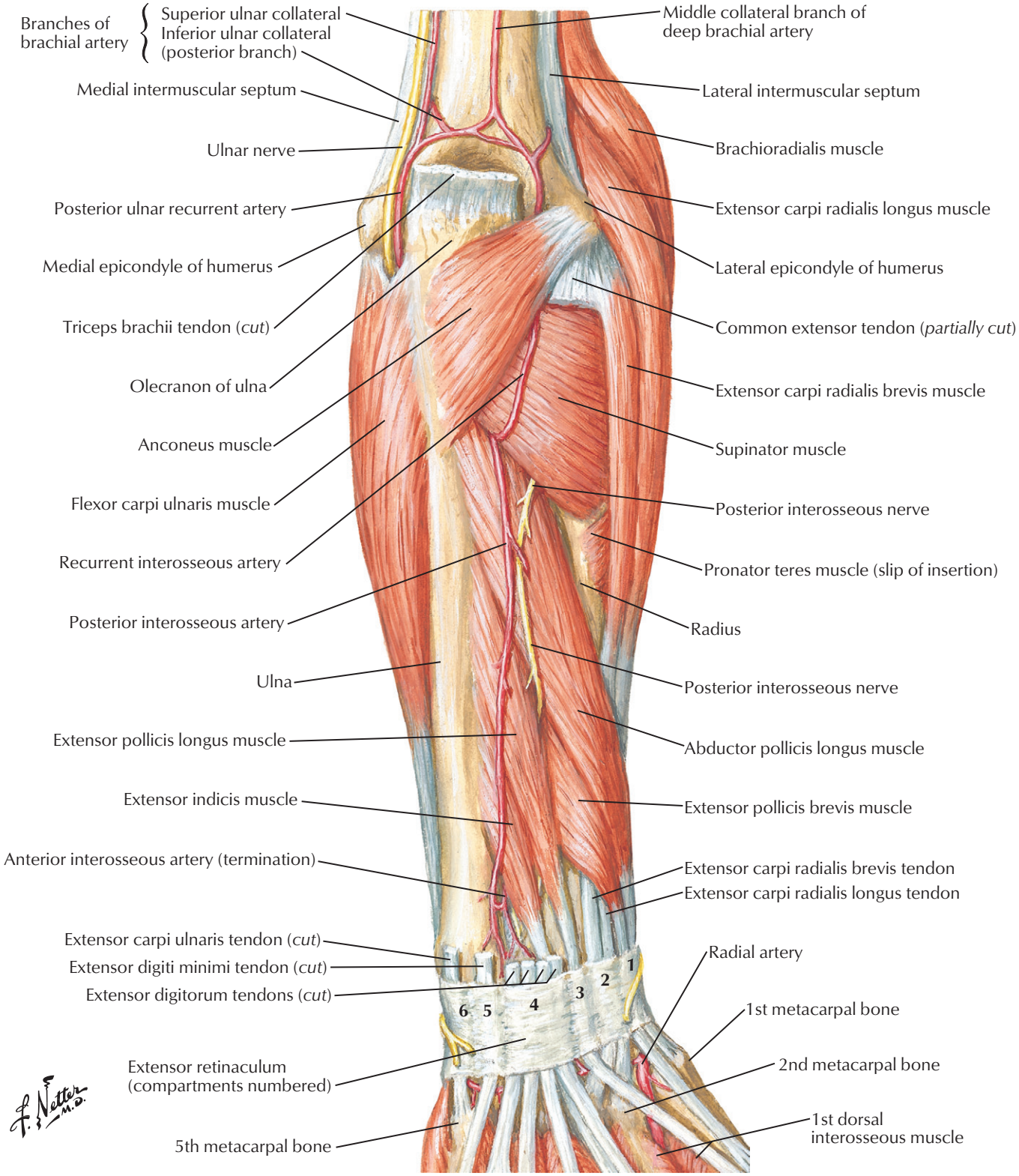
Muscles of Forearm (Superficial Layer): Posterior View

See also Plates 457, 466



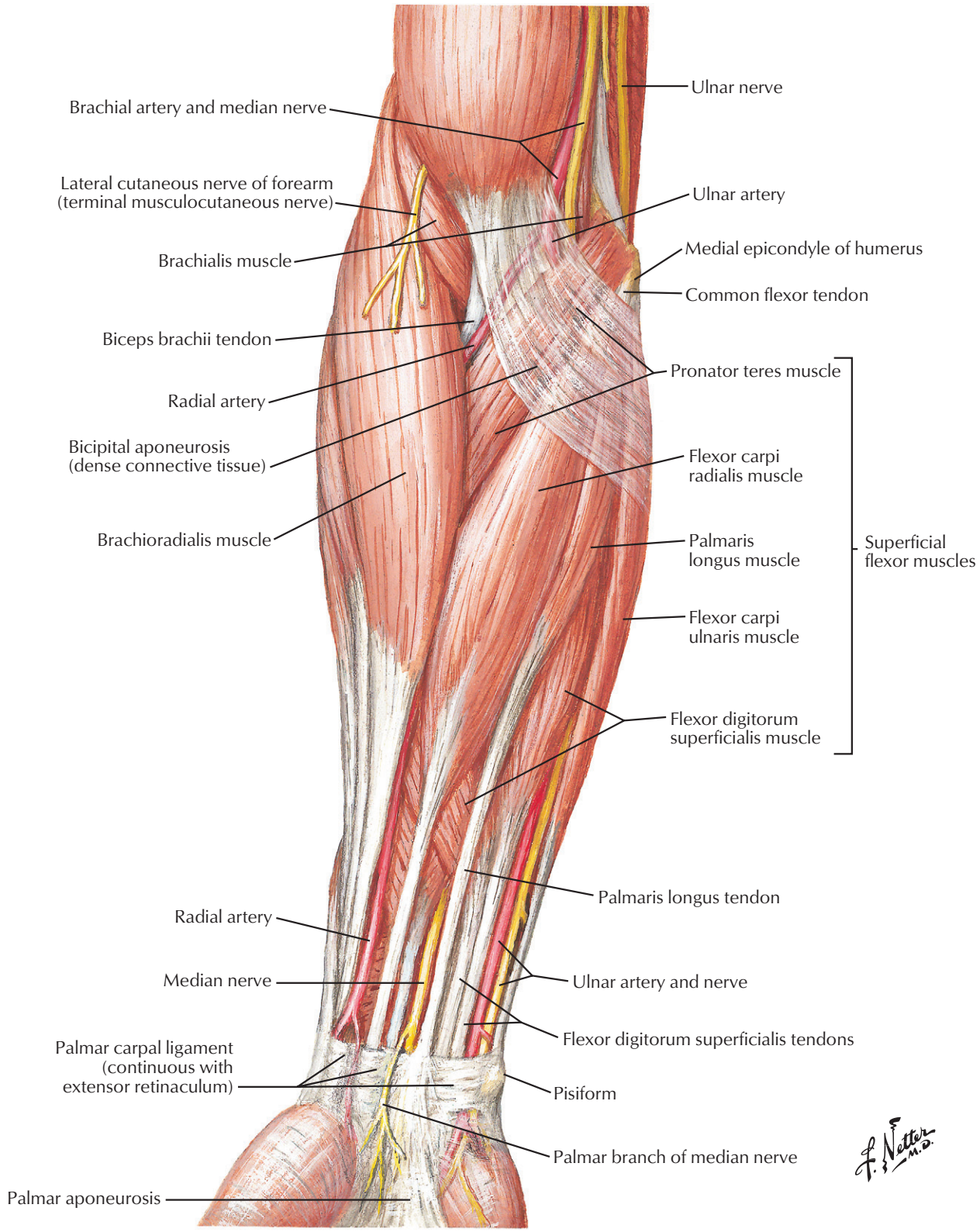
Muscles of Forearm (Deep Layer): Posterior View

See also Plates 402, 457



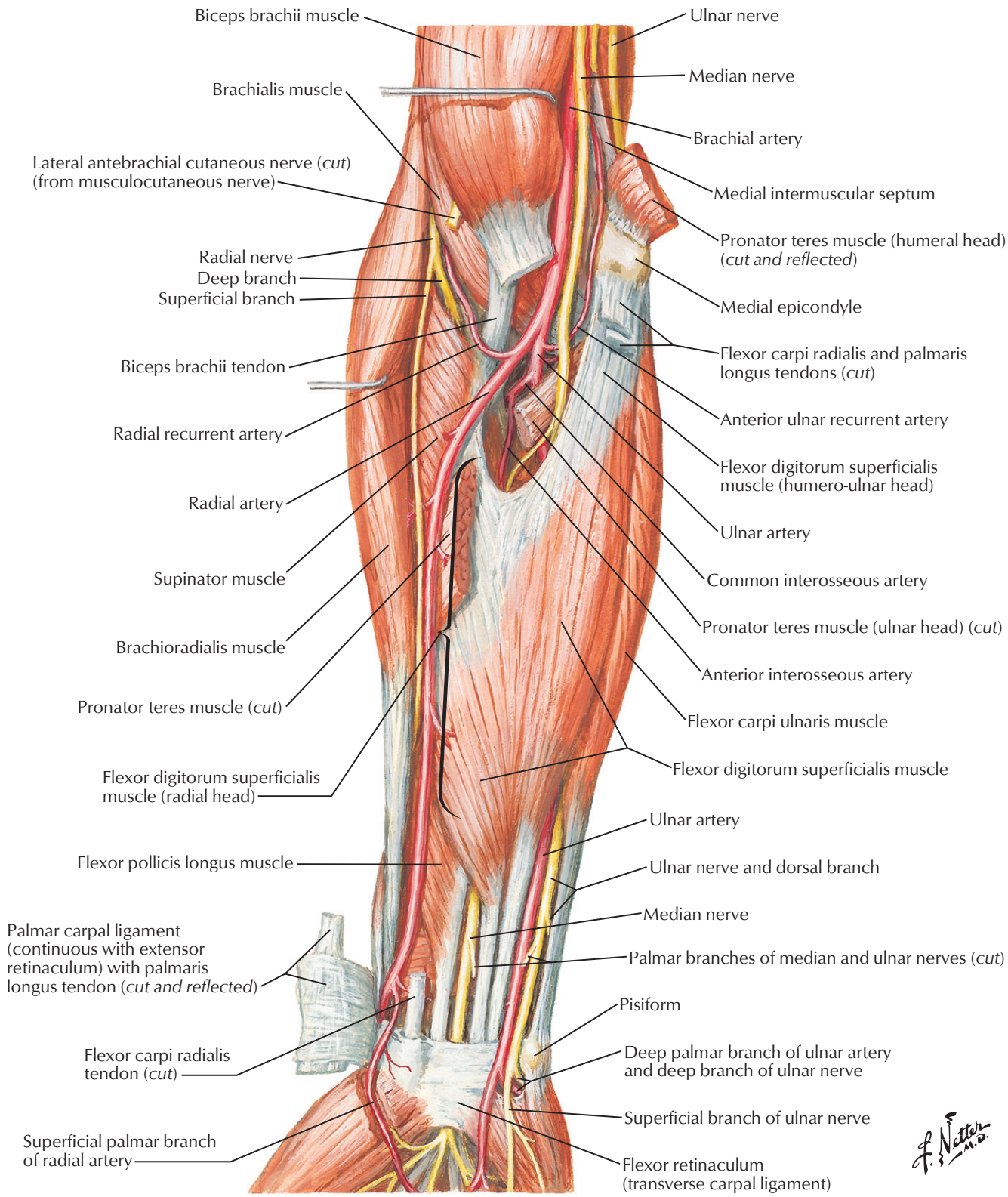
Muscles of Forearm (Superficial Layer): Anterior View

See also Plates 463, 464



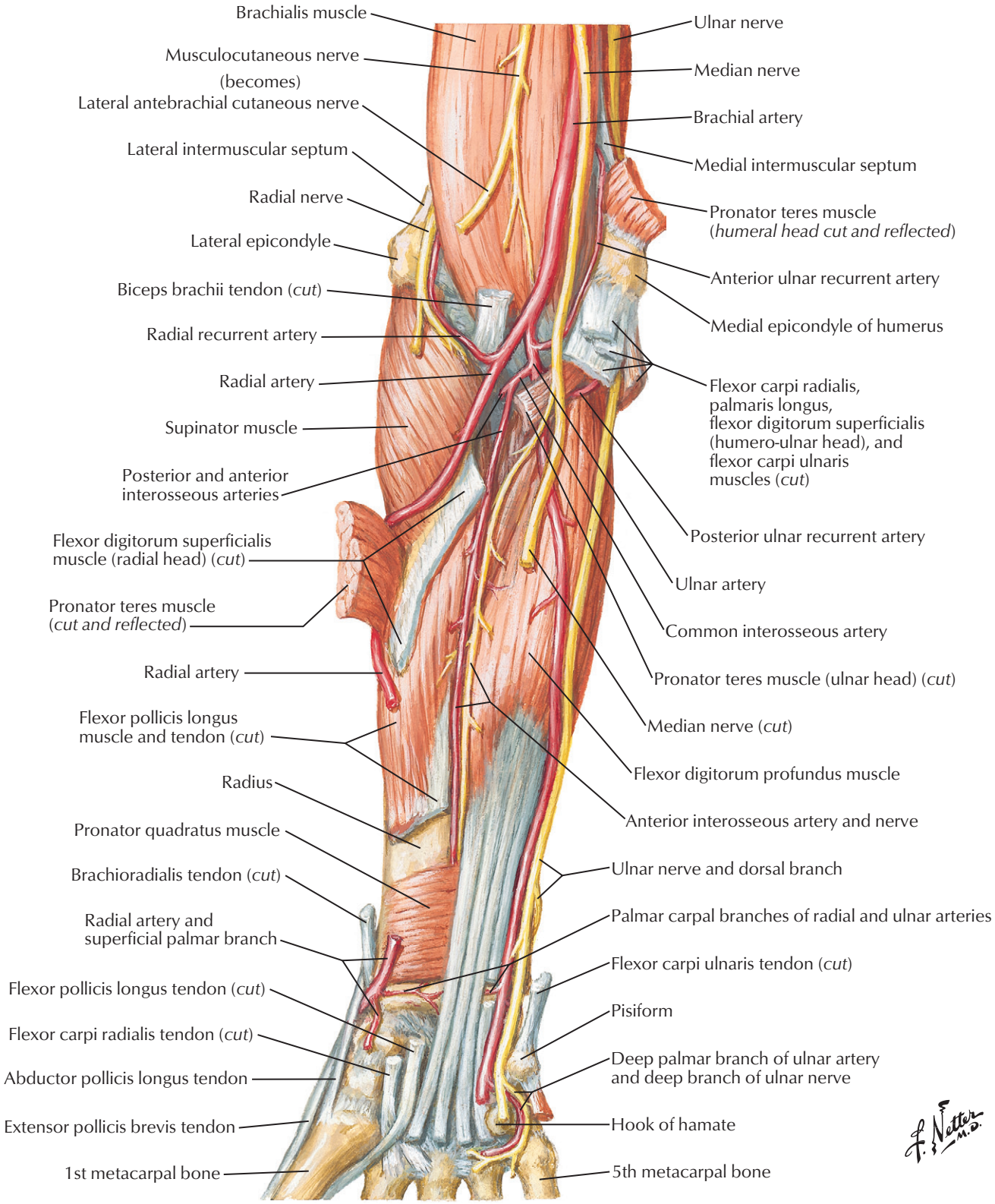
Muscles of Forearm (Intermediate Layer): Anterior View

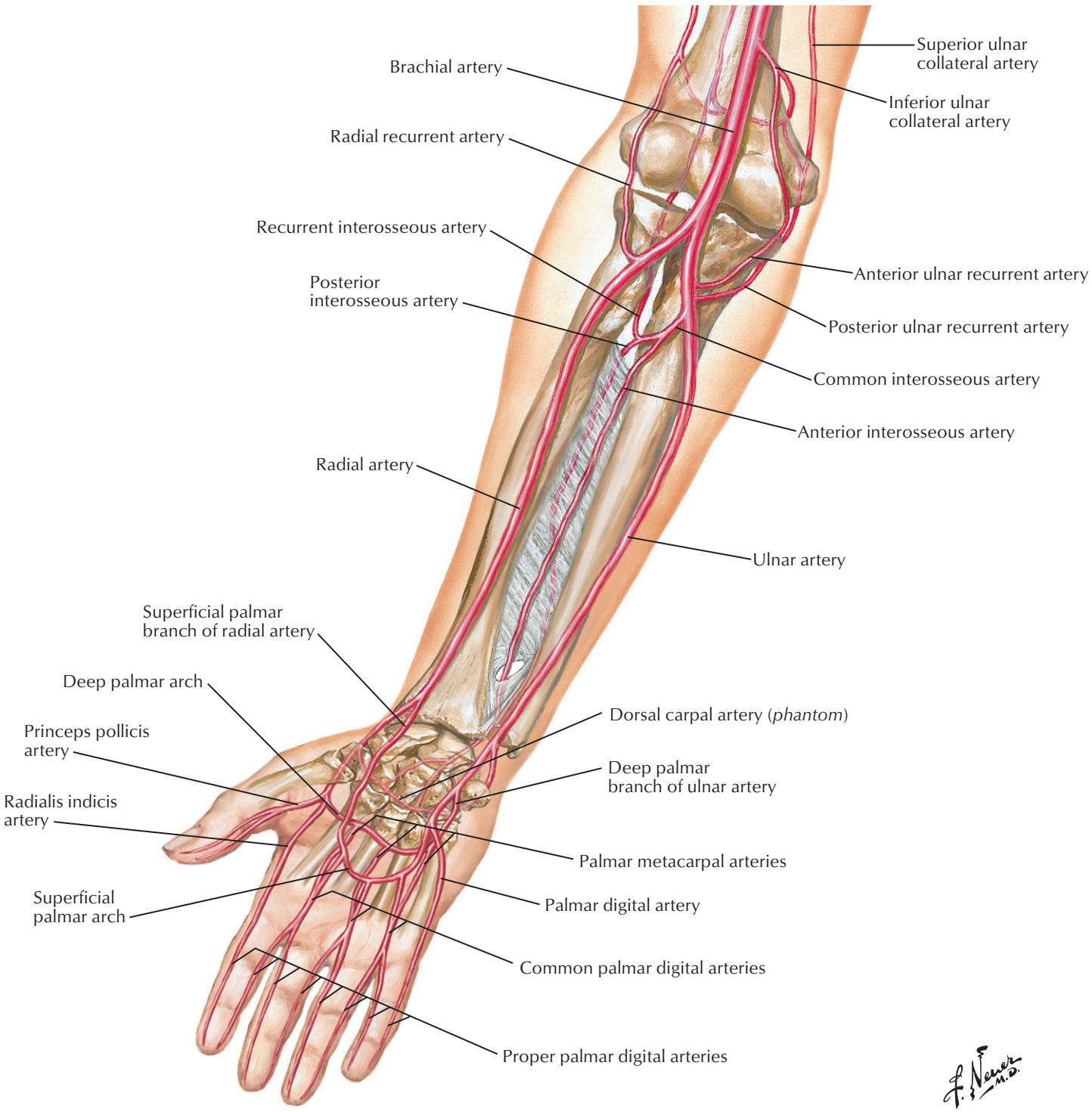
See also **Plates 420, 463, 464**

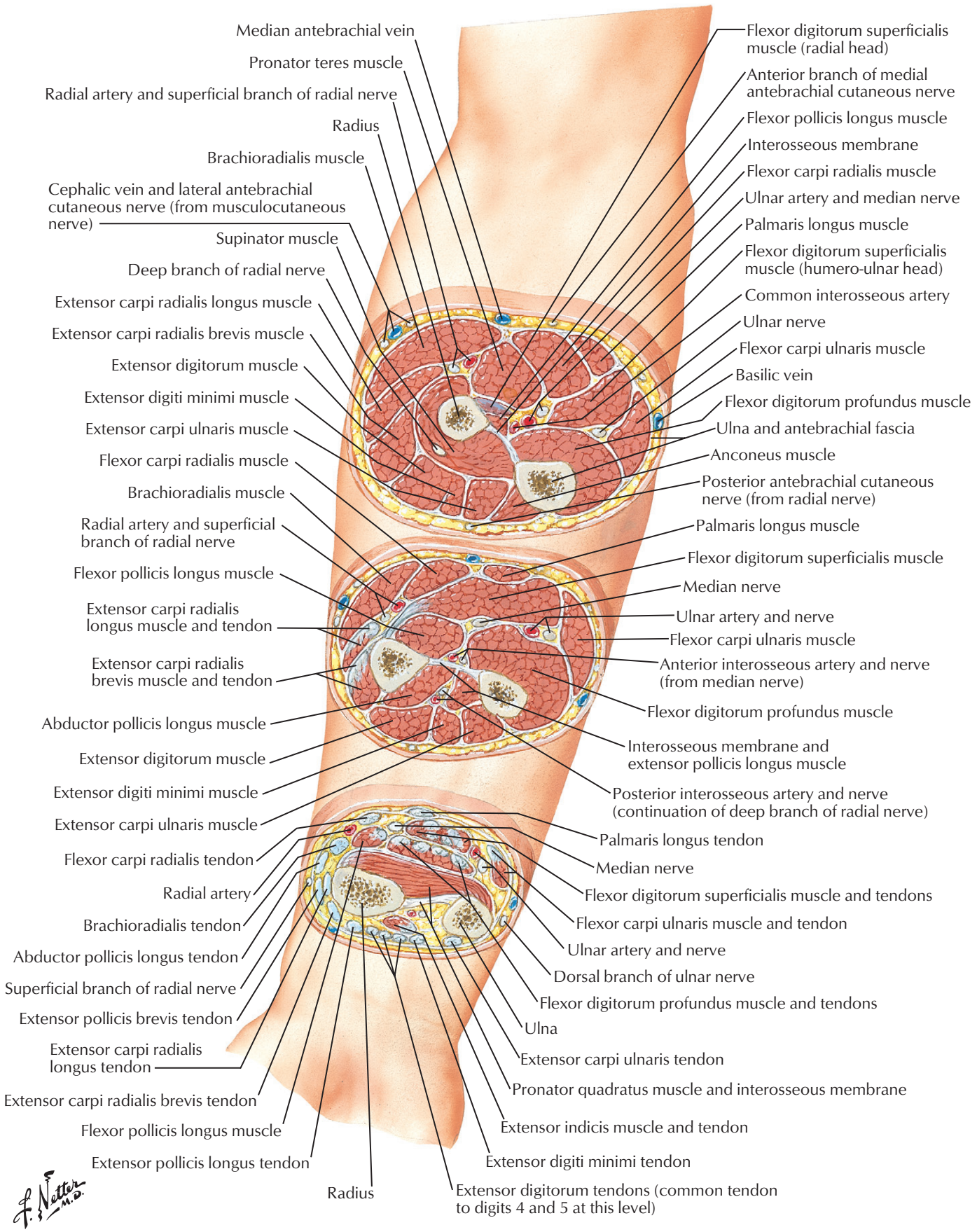


Muscles of Forearm (Deep Layer): Anterior View

See also Plates 426, 464

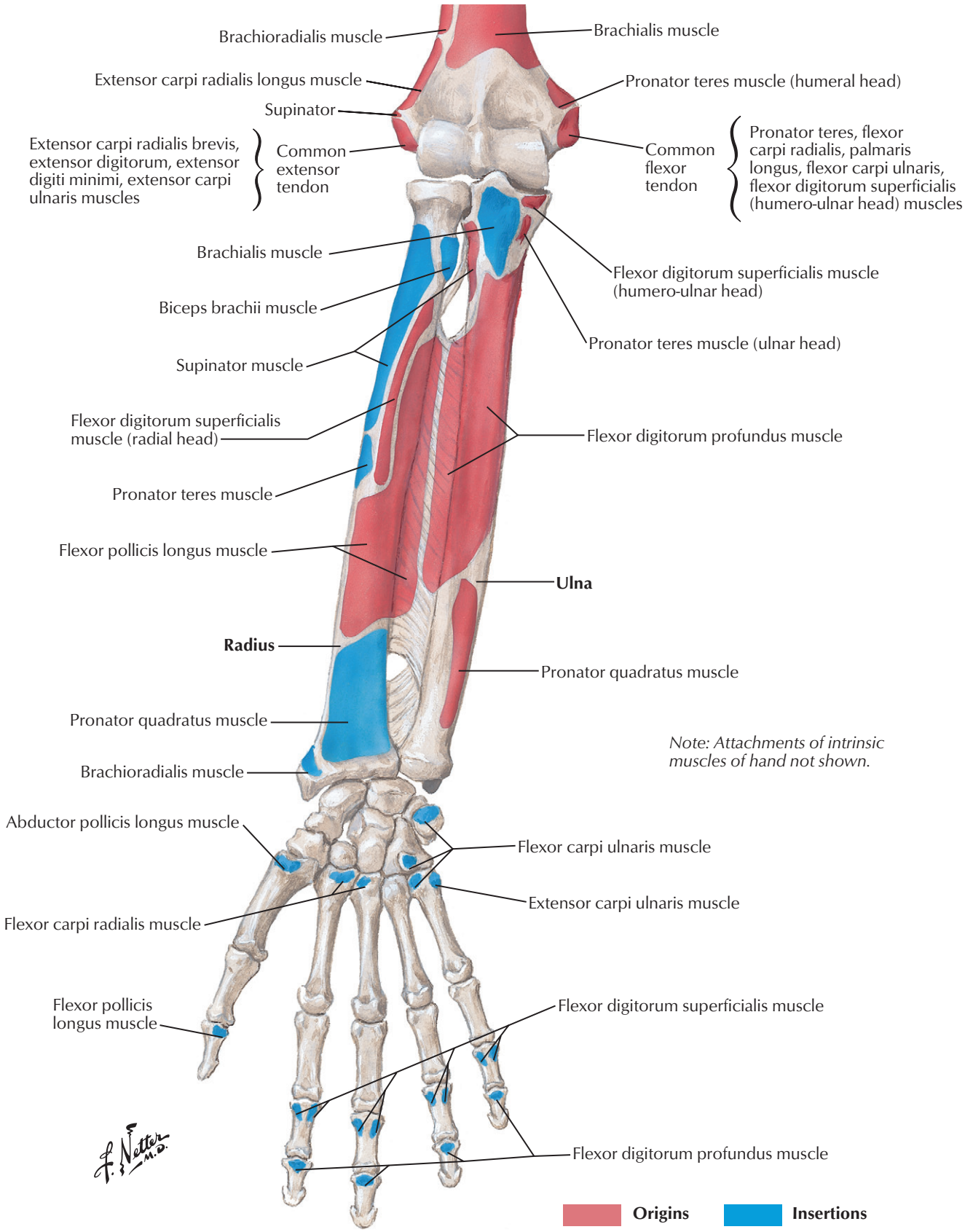



Brachial artery
Radial recurrent artery
Recurrent interosseous artery
Posterior interosseous artery
Radial artery
Superficial palmar branch of radial artery
Deep palmar arch
Princeps pollicis artery
Radialis indicis artery
Superficial palmar arch
Superior ulnar collateral artery
Inferior ulnar collateral artery
Anterior ulnar recurrent artery
Posterior ulnar recurrent artery
Common interosseous artery
Anterior interosseous artery
Ulnar artery
Dorsal carpal artery (*phantom*)
Deep palmar branch of ulnar artery
Palmar metacarpal arteries
Palmar digital artery
Common palmar digital arteries
Proper palmar digital arteries


Median antebrachial vein
Pronator teres muscle
Radial artery and superficial branch of radial nerve
Radius
Brachioradialis muscle
Cephalic vein and lateral antebrachial cutaneous nerve (from musculocutaneous nerve)
Supinator muscle
Deep branch of radial nerve
Extensor carpi radialis longus muscle
Extensor carpi radialis brevis muscle
Extensor digitorum muscle
Extensor digiti minimi muscle
Extensor carpi ulnaris muscle
Flexor carpi radialis muscle
Brachioradialis muscle
Radial artery and superficial branch of radial nerve
Flexor pollicis longus muscle
Extensor carpi radialis longus muscle and tendon
Extensor carpi radialis brevis muscle and tendon
Abductor pollicis longus muscle
Extensor digitorum muscle
Extensor digiti minimi muscle
Extensor carpi ulnaris muscle
Flexor carpi radialis tendon
Radial artery
Brachioradialis tendon
Abductor pollicis longus tendon
Superficial branch of radial nerve
Extensor pollicis brevis tendon
Extensor carpi radialis longus tendon
Extensor carpi radialis brevis tendon
Flexor pollicis longus muscle
Extensor pollicis longus tendon
Radius
Flexor digitorum superficialis muscle (radial head)
Anterior branch of medial antebrachial cutaneous nerve
Flexor pollicis longus muscle
Interosseous membrane
Flexor carpi radialis muscle
Ulnar artery and median nerve
Palmaris longus muscle
Flexor digitorum superficialis muscle (humero-ulnar head)
Common interosseous artery
Ulnar nerve
Flexor carpi ulnaris muscle
Basilic vein
Flexor digitorum profundus muscle
Ulna and antebrachial fascia
Anconeus muscle
Posterior antebrachial cutaneous nerve (from radial nerve)
Palmaris longus muscle
Flexor digitorum superficialis muscle
Median nerve
Ulnar artery and nerve
Flexor carpi ulnaris muscle
Anterior interosseous artery and nerve (from median nerve)
Flexor digitorum profundus muscle
Interosseous membrane and extensor pollicis longus muscle
Posterior interosseous artery and nerve (continuation of deep branch of radial nerve)
Palmaris longus tendon
Median nerve
Flexor digitorum superficialis muscle and tendons
Flexor carpi ulnaris muscle and tendon
Ulnar artery and nerve
Dorsal branch of ulnar nerve
Flexor digitorum profundus muscle and tendons
Ulna
Extensor carpi ulnaris tendon
Pronator quadratus muscle and interosseous membrane
Extensor indicis muscle and tendon
Extensor digiti minimi tendon
Extensor digitorum tendons (common tendon to digits 4 and 5 at this level)

Attachments of Muscles of Forearm: Anterior View

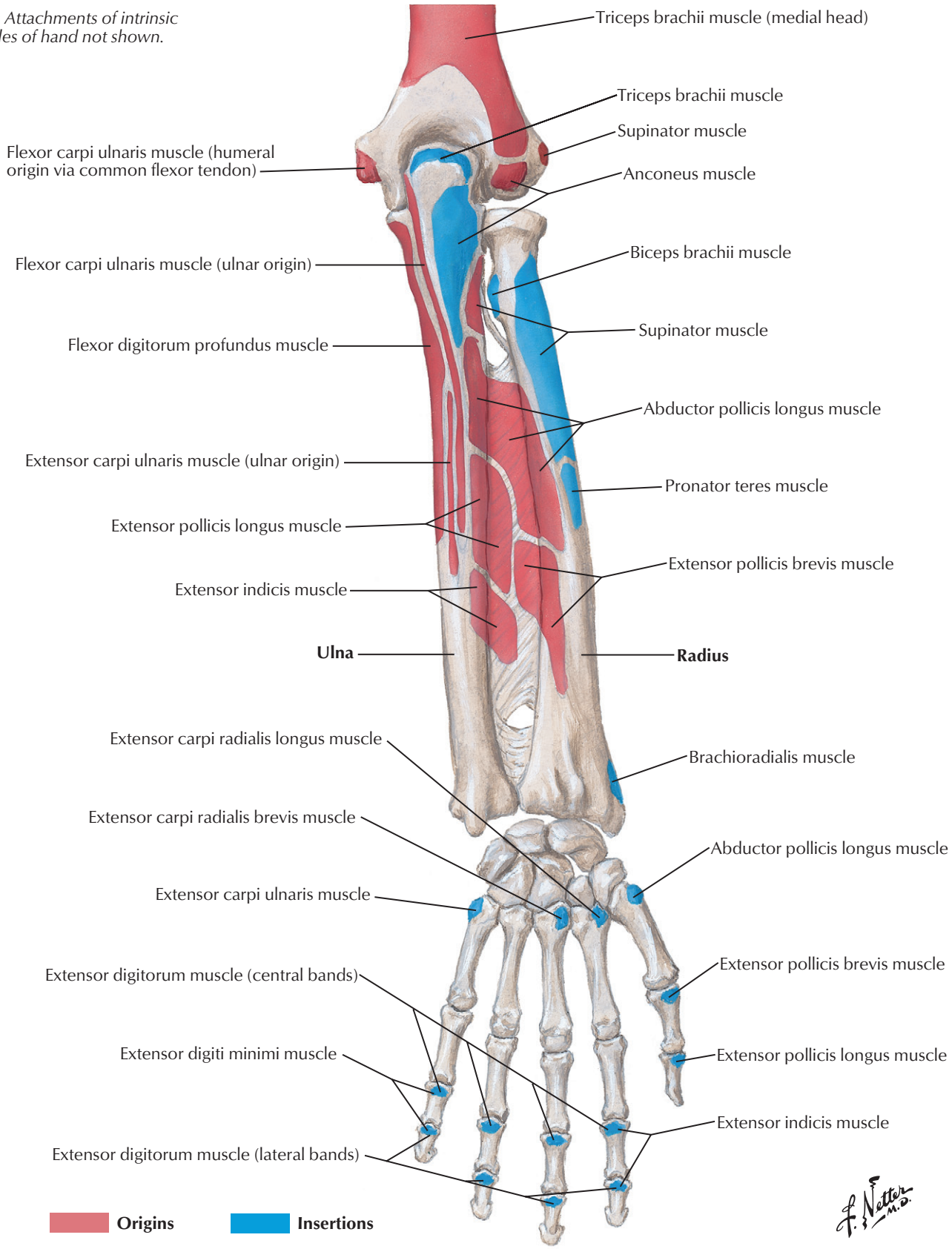
See also Plate 422

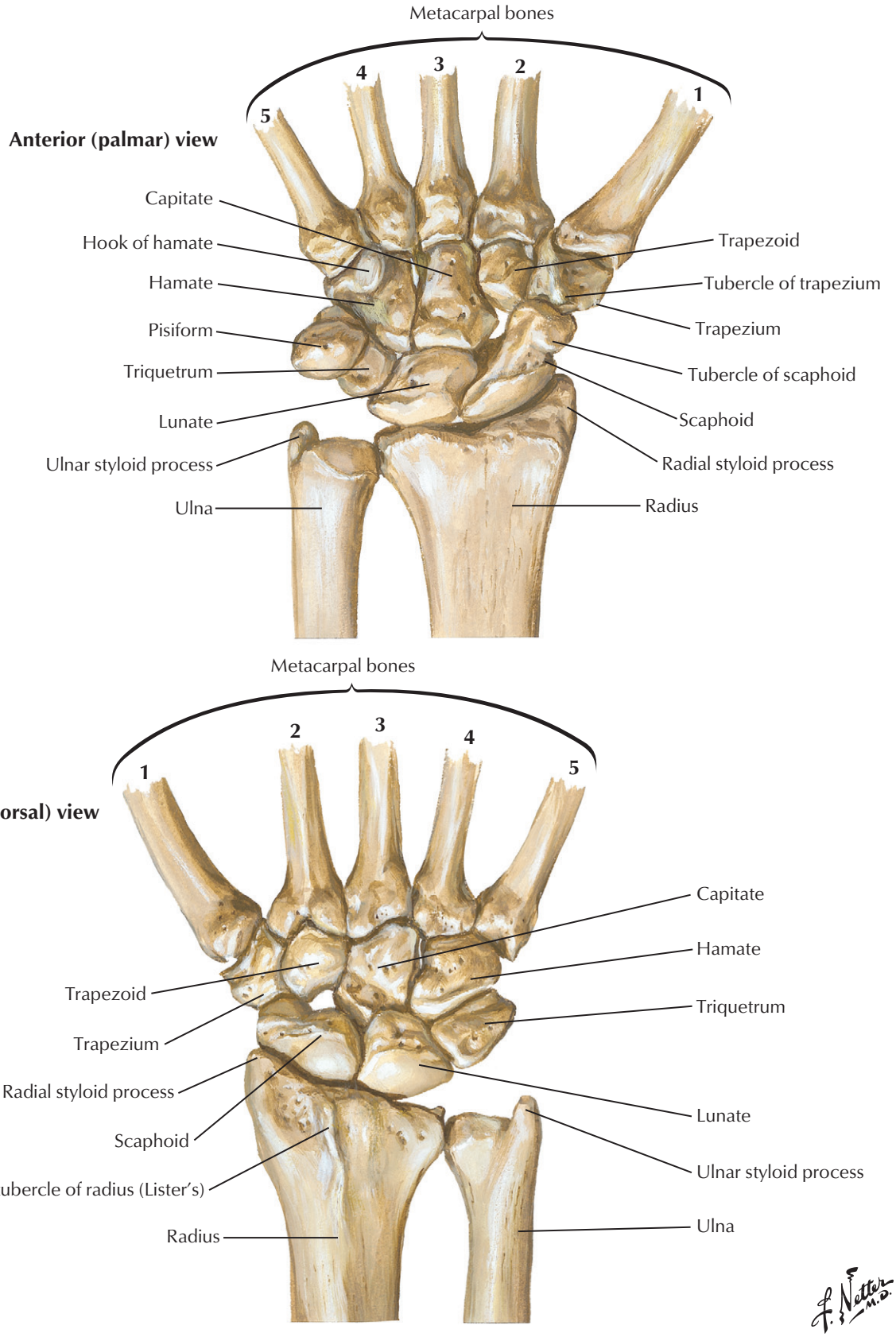


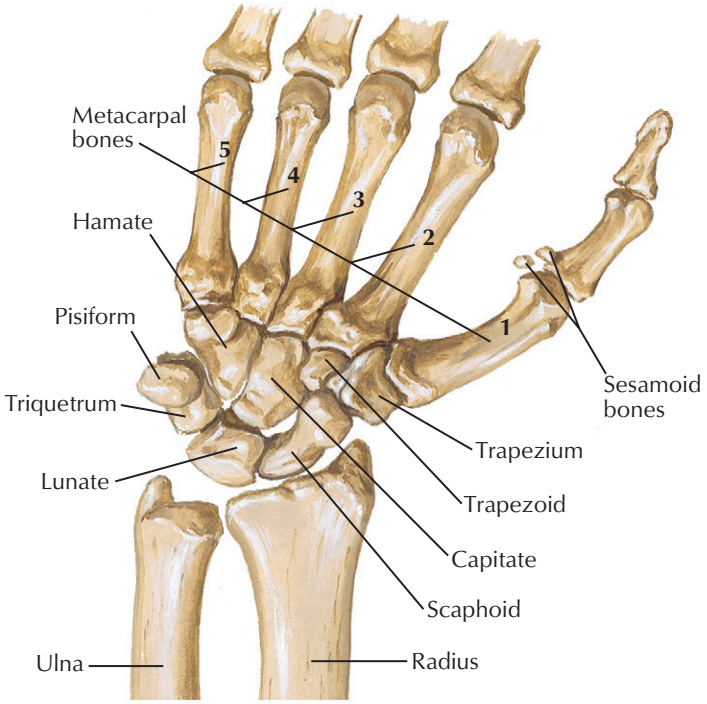
Attachments of Muscles of Forearm: Posterior View

See also Plate 427

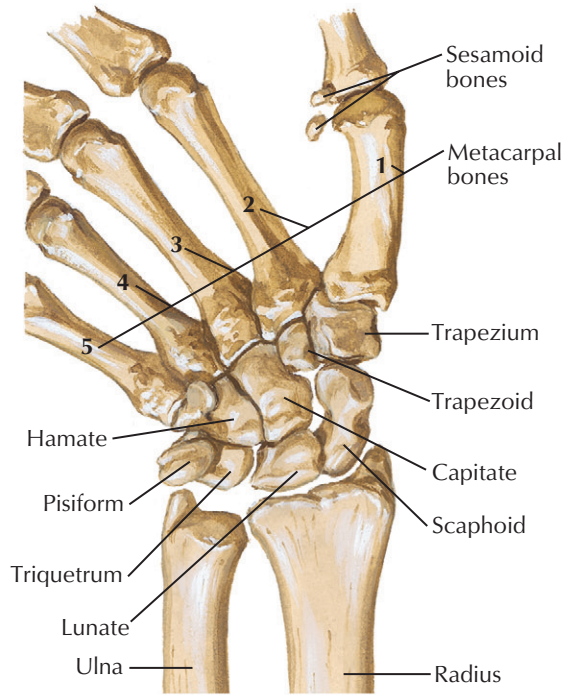
Note: Attachments of intrinsic muscles of hand not shown.



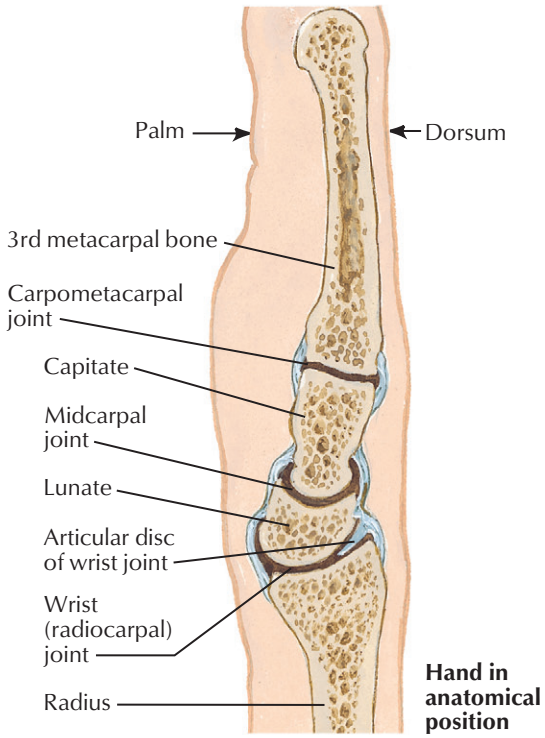

Anterior (palmar) view
Metacarpal bones
1
2
3
4
5
Capitate
Hook of hamate
Hamate
Pisiform
Triquetrum
Lunate
Ulnar styloid process
Ulna
Trapezoid
Tubercle of trapezium
Trapezium
Tubercle of scaphoid
Scaphoid
Radial styloid process
Radius
Posterior (dorsal) view
Metacarpal bones
1
2
3
4
5
Trapezoid
Trapezium
Radial styloid process
Scaphoid
Dorsal tubercle of radius (Lister's)
Radius
Capitate
Hamate
Triquetrum
Lunate
Ulnar styloid process
Ulna



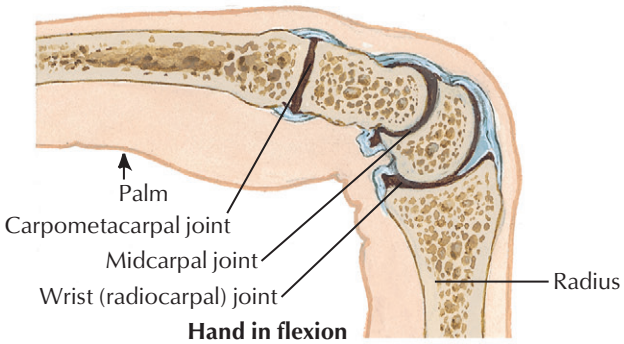
Position of carpal bones with hand in abduction: anterior (palmar) view

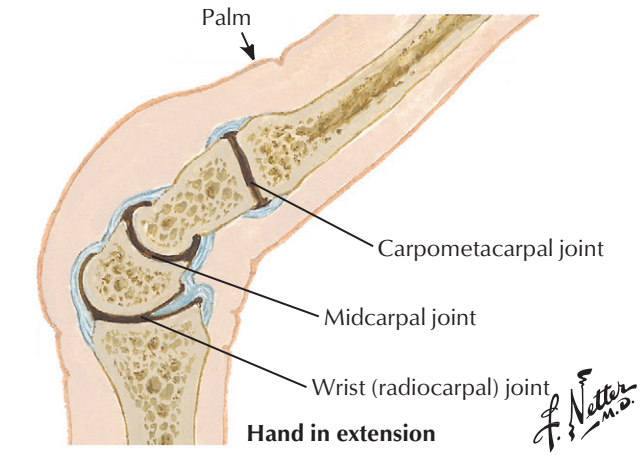


Position of carpal bones with hand in adduction: anterior (palmar) view

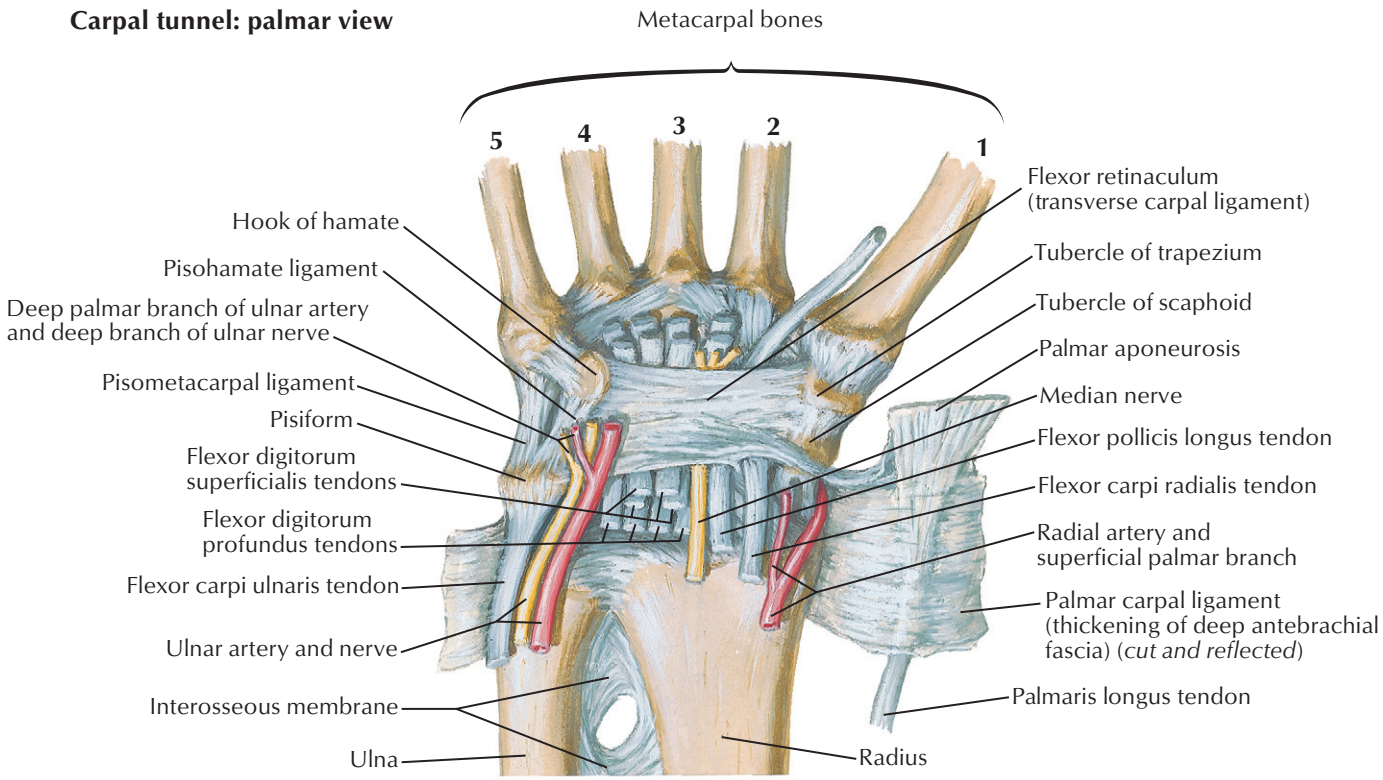


Sagittal sections through wrist and middle finger

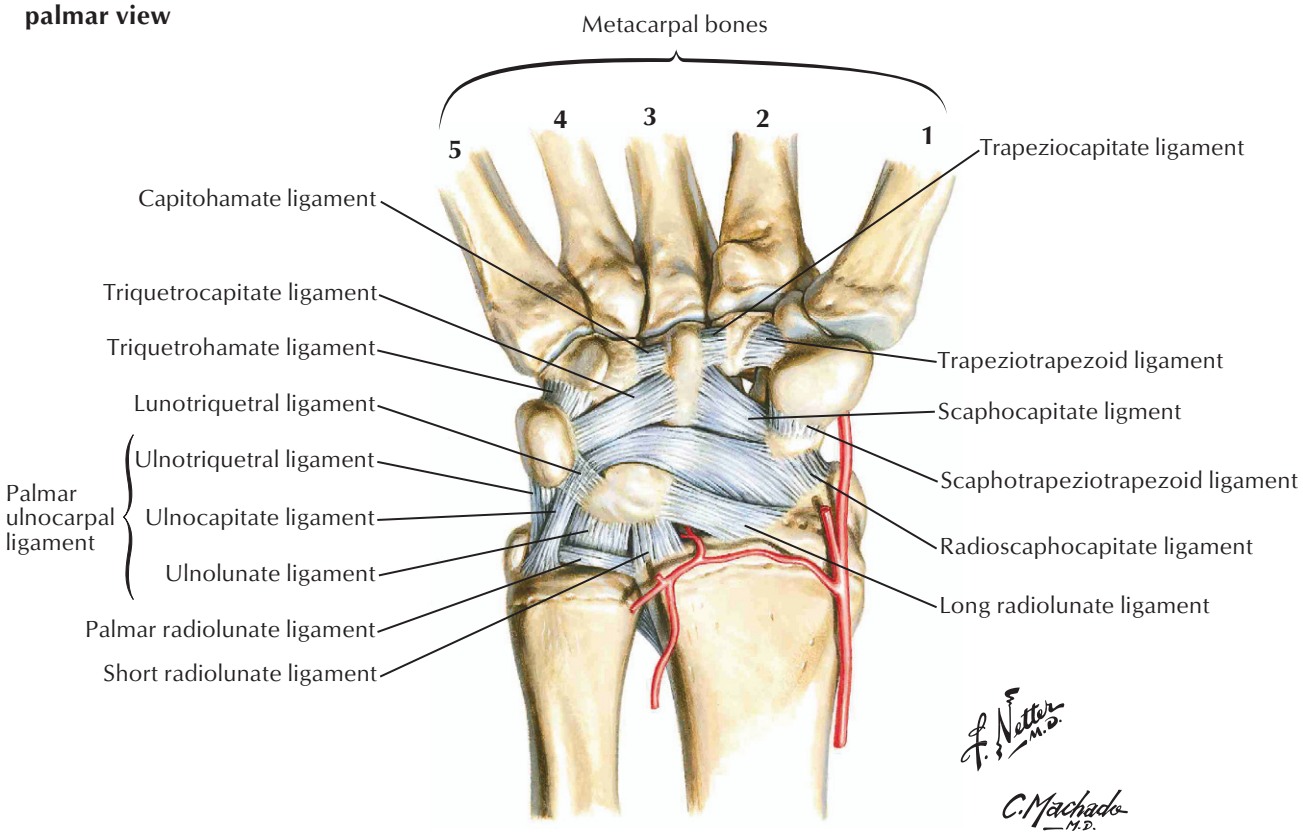




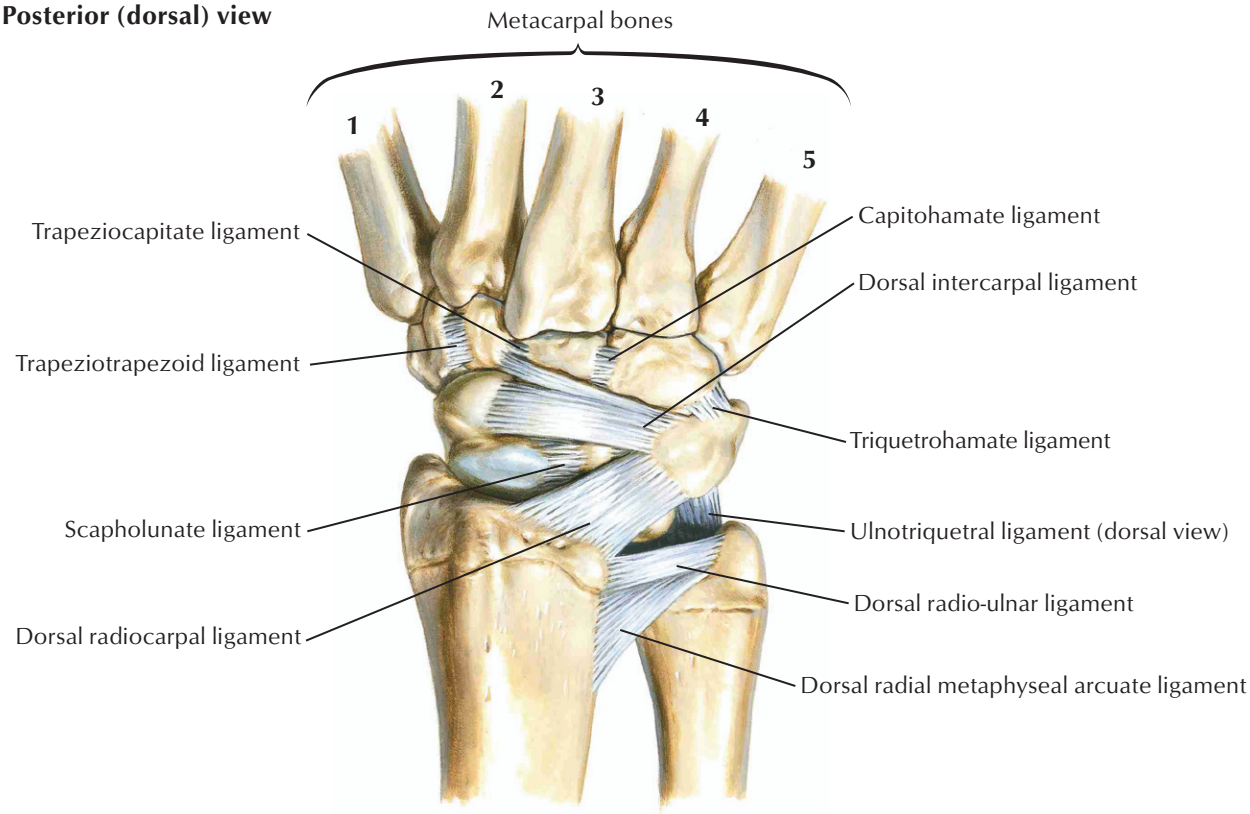
Carpal tunnel: palmar view



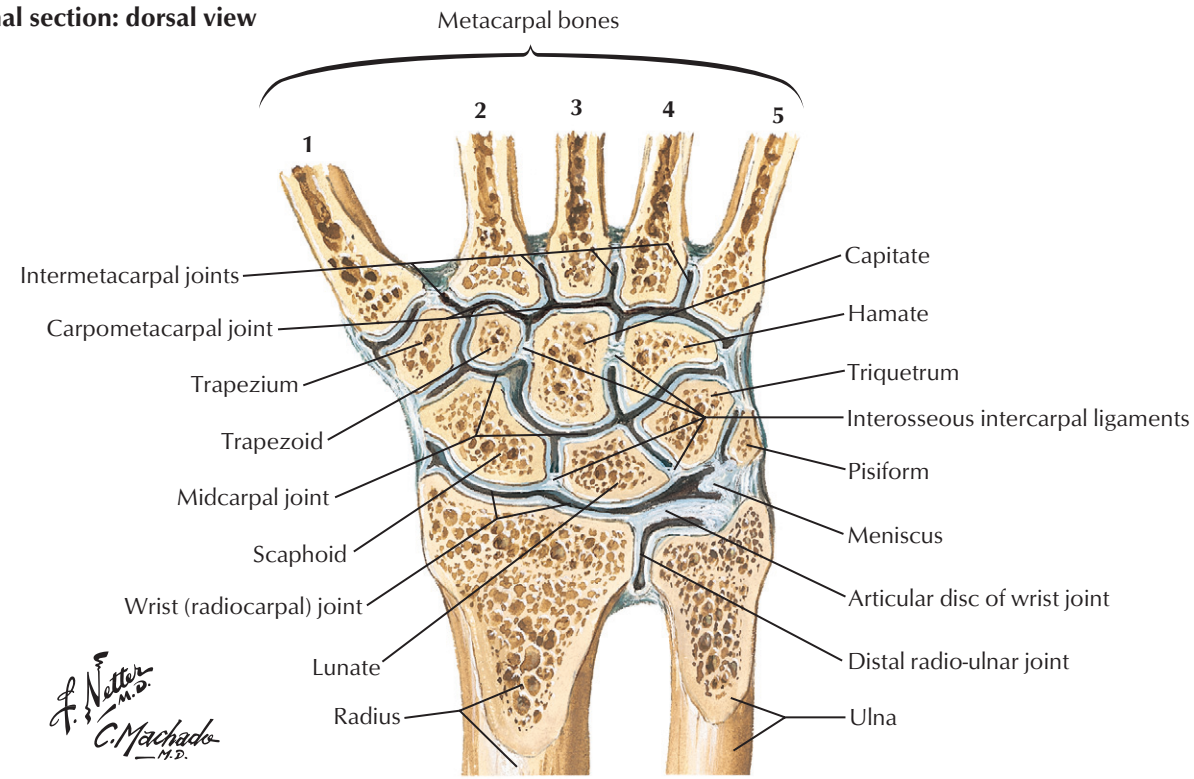
Flexor retinaculum removed: palmar view

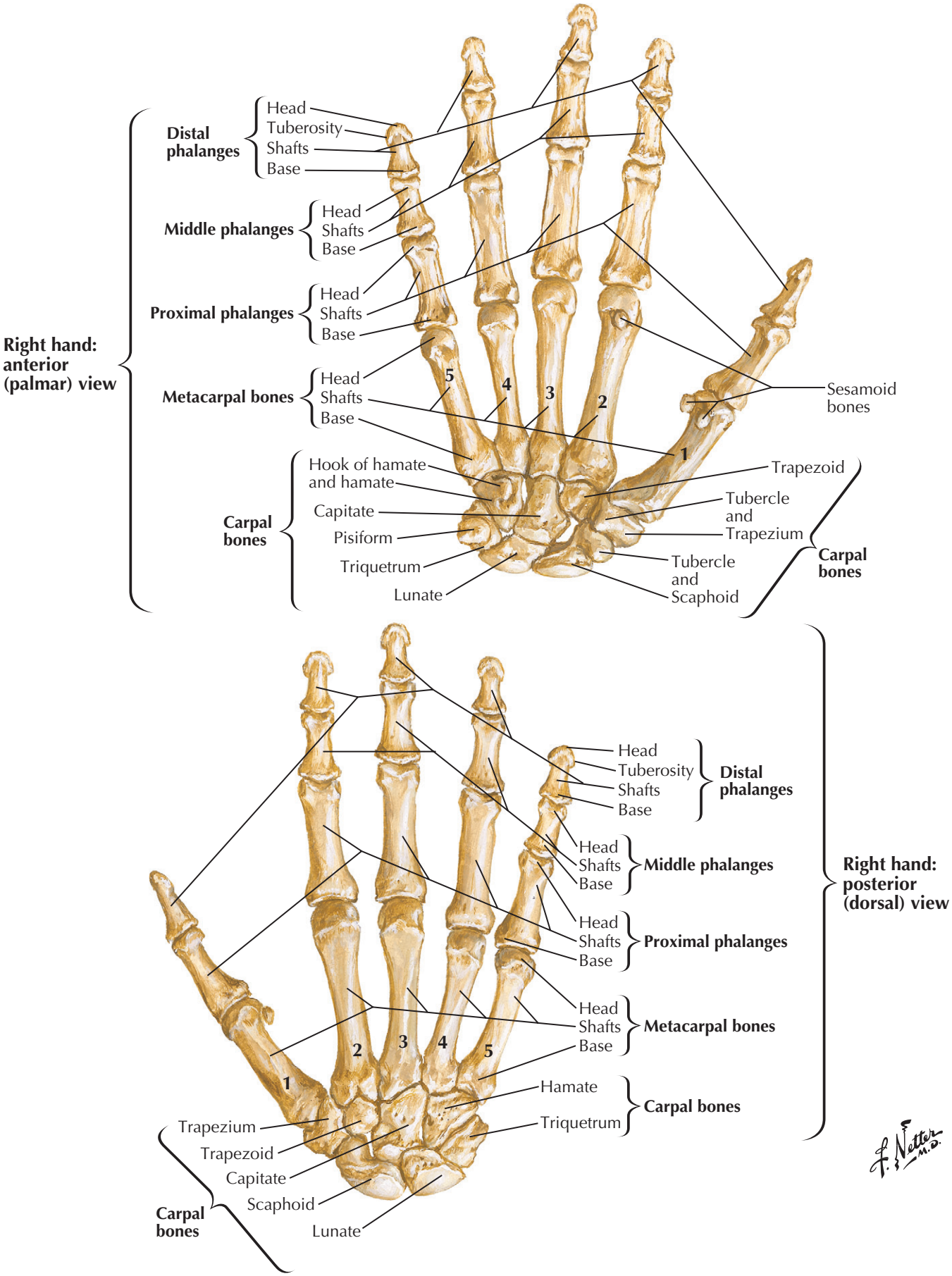


Posterior (dorsal) view



Coronal section: dorsal view




Right hand: anterior (palmar) view
Distal phalanges
Head
Tuberosity
Shafts
Base
Middle phalanges
Head
Shafts
Base
Proximal phalanges
Head
Shafts
Base
Metacarpal bones
Head
Shafts
Base
5
4
3
2
1
Sesamoid bones
Carpal bones
Hook of hamate and hamate
Capitate
Pisiform
Triquetrum
Lunate
Trapezoid
Tubercle and Trapezium
Tubercle and Scaphoid
Carpal bones
Right hand: posterior (dorsal) view
Distal phalanges
Head
Tuberosity
Shafts
Base
Middle phalanges
Head
Shafts
Base
Proximal phalanges
Head
Shafts
Base
Metacarpal bones
Head
Shafts
Base
Carpal bones
Hamate
Triquetrum
1
2
3
4
5
Carpal bones
Trapezium
Trapezoid
Capitate
Scaphoid
Lunate

See also Plate 456

Anteroposterior view

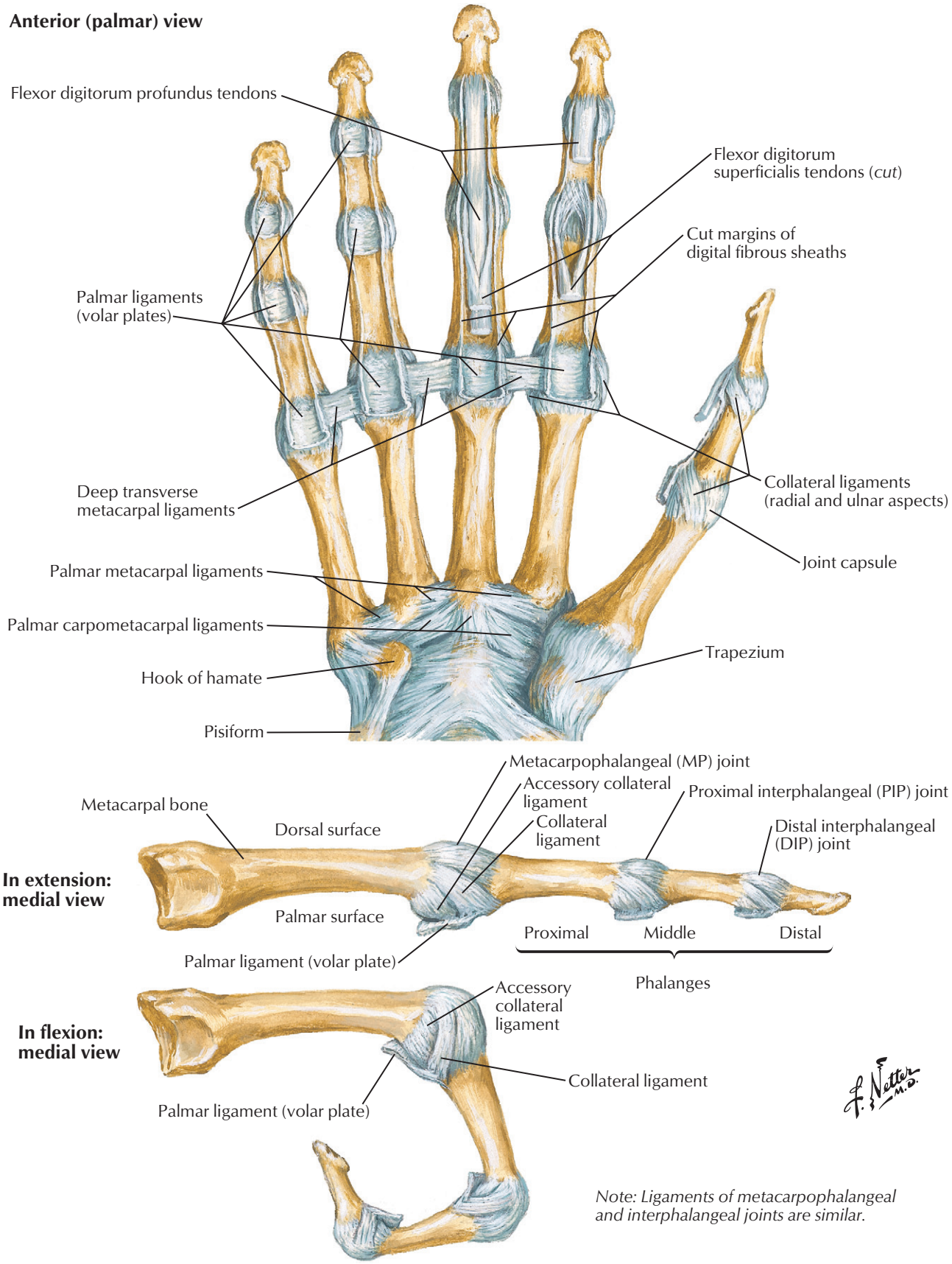


Lateral view



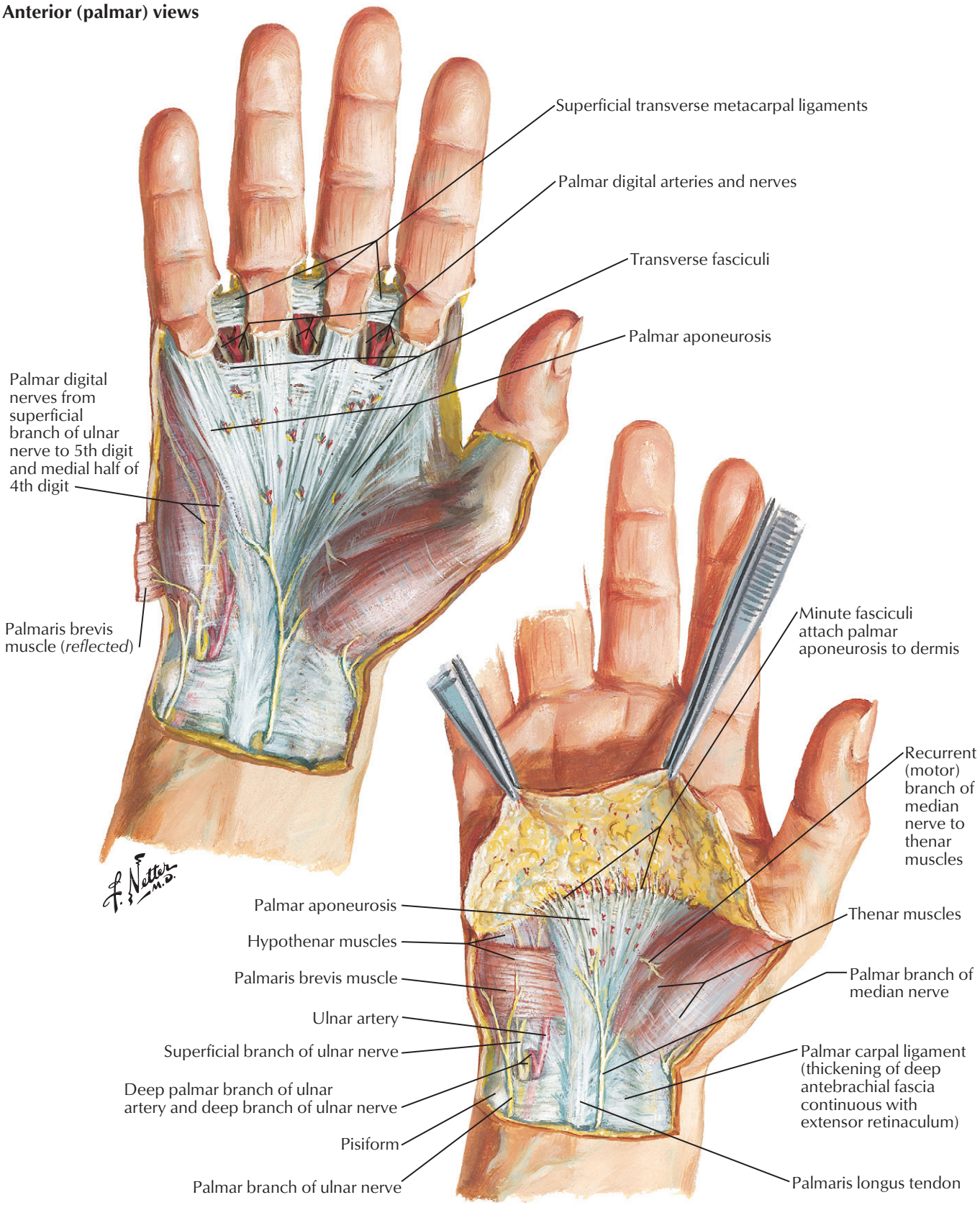
Metacarpophalangeal and Interphalangeal Ligaments

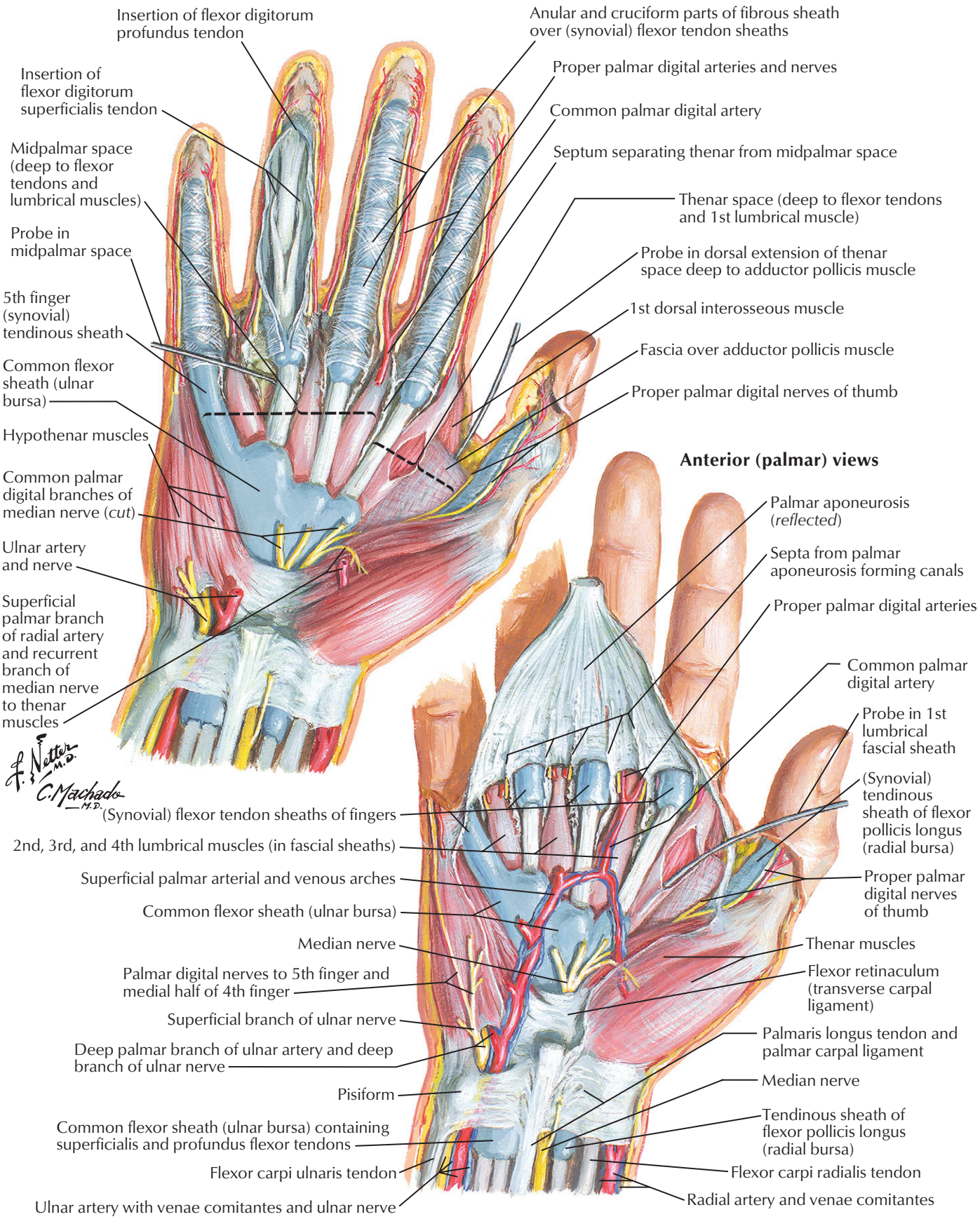
See also **Plates 448, 451**



Note: Ligaments of metacarpophalangeal and interphalangeal joints are similar.

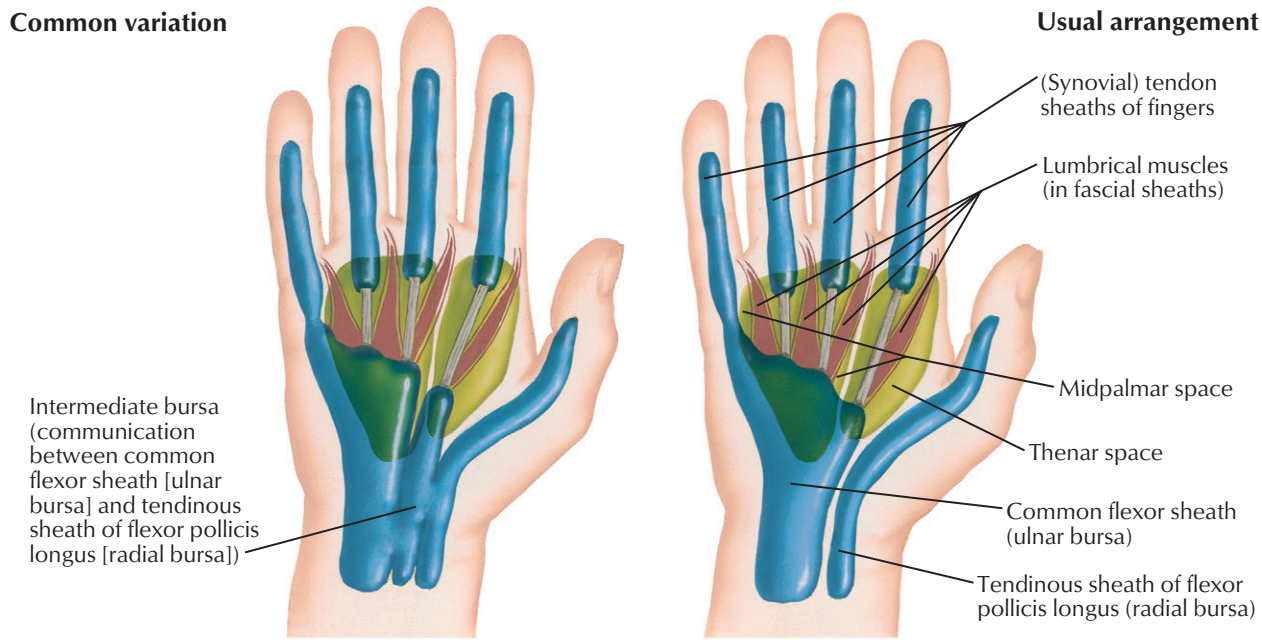
Anterior (palmar) views



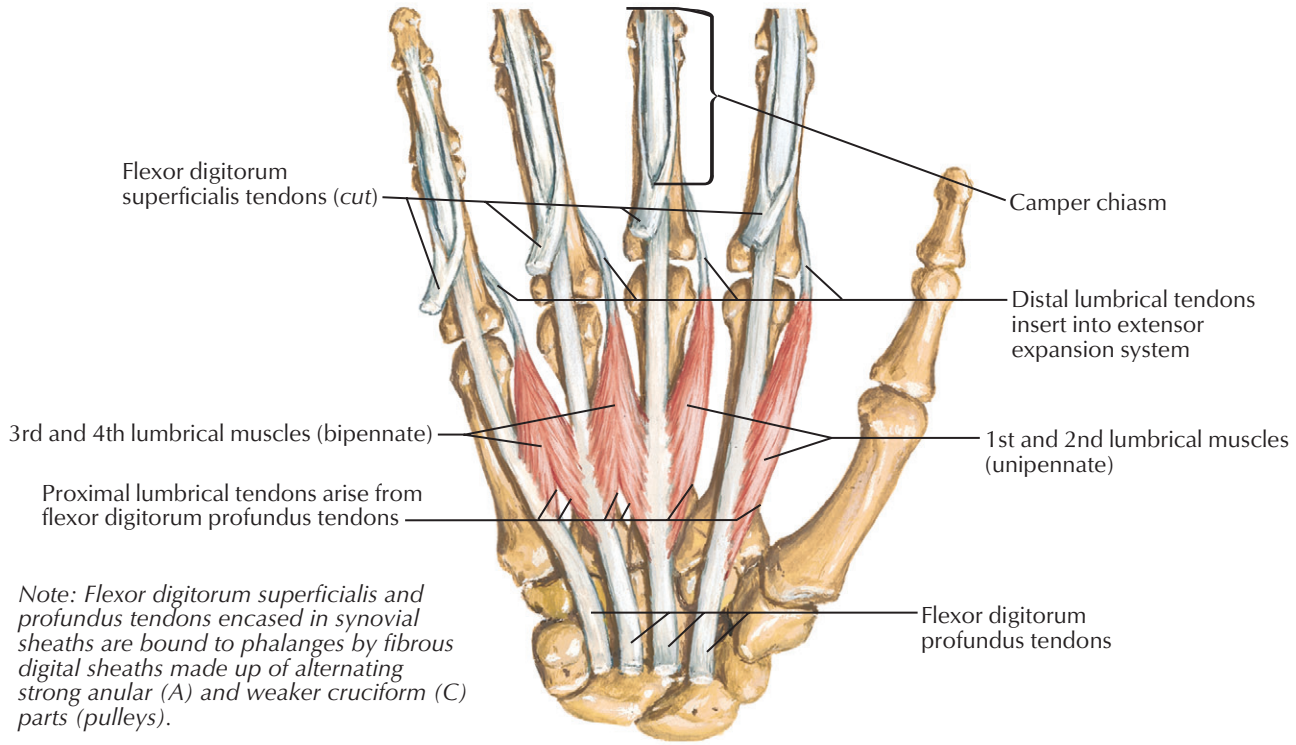

Insertion of flexor digitorum profundus tendon
Insertion of flexor digitorum superficialis tendon
Midpalmar space (deep to flexor tendons and lumbrical muscles)
Probe in midpalmar space
5th finger (synovial) tendinous sheath
Common flexor sheath (ulnar bursa)
Hypothenar muscles
Common palmar digital branches of median nerve (cut)
Ulnar artery and nerve
Superficial palmar branch of radial artery and recurrent branch of median nerve to thenar muscles
Anular and cruciform parts of fibrous sheath over (synovial) flexor tendon sheaths
Proper palmar digital arteries and nerves
Common palmar digital artery
Septum separating thenar from midpalmar space
Thenar space (deep to flexor tendons and 1st lumbrical muscle)
Probe in dorsal extension of thenar space deep to adductor pollicis muscle
1st dorsal interosseous muscle
Fascia over adductor pollicis muscle
Proper palmar digital nerves of thumb
F. Netter M.D.
C. Machado M.D.
Anterior (palmar) views
Palmar aponeurosis (reflected)
Septa from palmar aponeurosis forming canals
Proper palmar digital arteries
Common palmar digital artery
Probe in 1st lumbrical fascial sheath
(Synovial) tendinous sheath of flexor pollicis longus (radial bursa)
Proper palmar digital nerves of thumb
Thenar muscles
Flexor retinaculum (transverse carpal ligament)
Palmaris longus tendon and palmar carpal ligament
Median nerve
Tendinous sheath of flexor pollicis longus (radial bursa)
Flexor carpi radialis tendon
Radial artery and venae comitantes
(Synovial) flexor tendon sheaths of fingers
2nd, 3rd, and 4th lumbrical muscles (in fascial sheaths)
Superficial palmar arterial and venous arches
Common flexor sheath (ulnar bursa)
Median nerve
Palmar digital nerves to 5th finger and medial half of 4th finger
Superficial branch of ulnar nerve
Deep palmar branch of ulnar artery and deep branch of ulnar nerve
Pisiform
Common flexor sheath (ulnar bursa) containing superficialis and profundus flexor tendons
Flexor carpi ulnaris tendon
Ulnar artery with venae comitantes and ulnar nerve

Lumbrical Muscles and Bursae, Spaces, and Sheaths: Schema

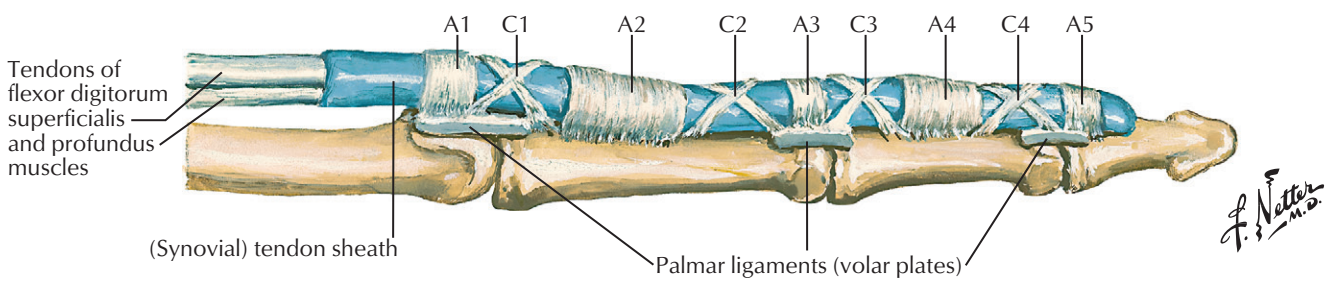
See also **Plate 445**



Lumbrical muscles: schema



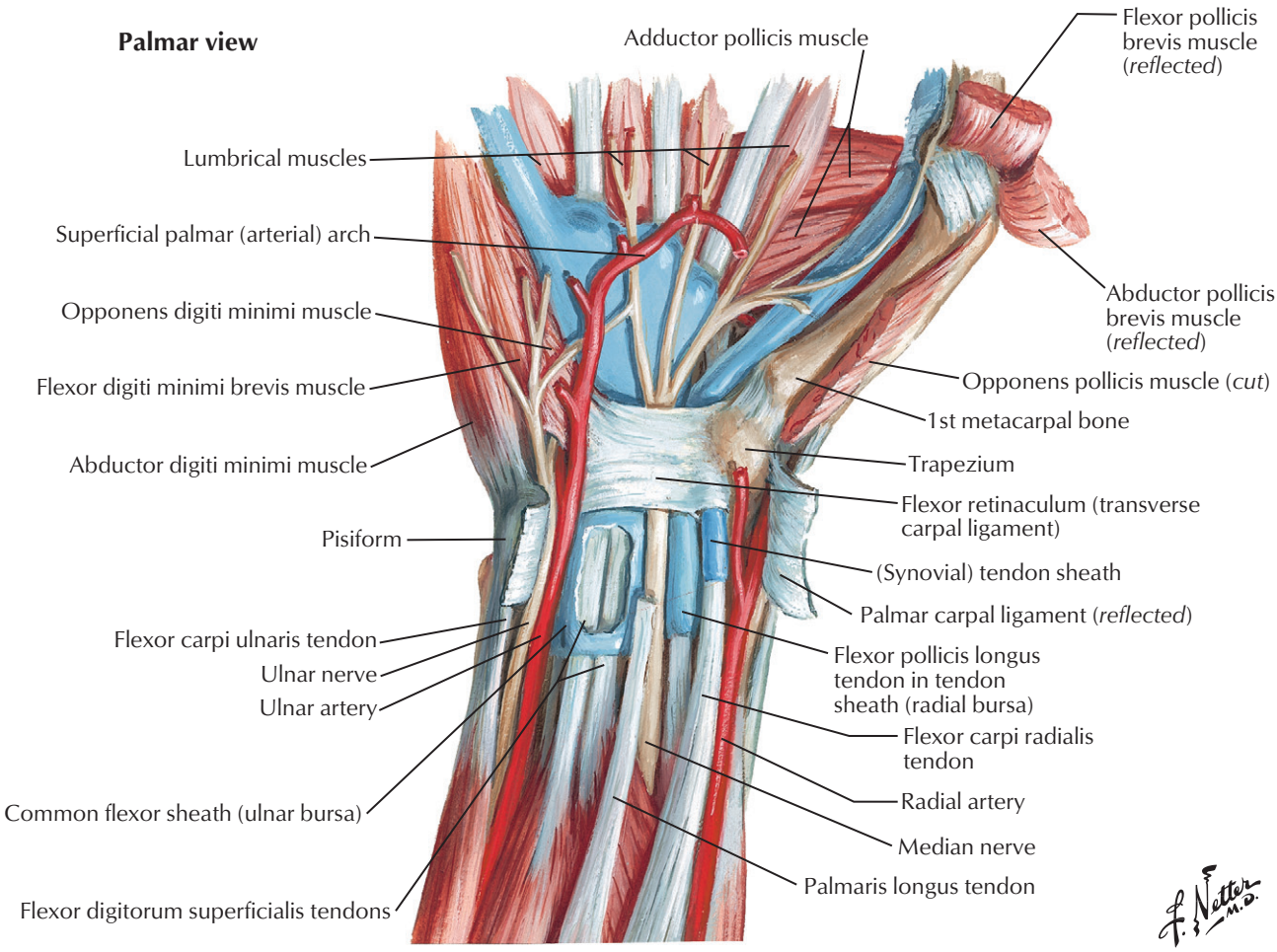
Note: Flexor digitorum superficialis and profundus tendons encased in synovial sheaths are bound to phalanges by fibrous digital sheaths made up of alternating strong anular (A) and weaker cruciform (C) parts (pulleys).



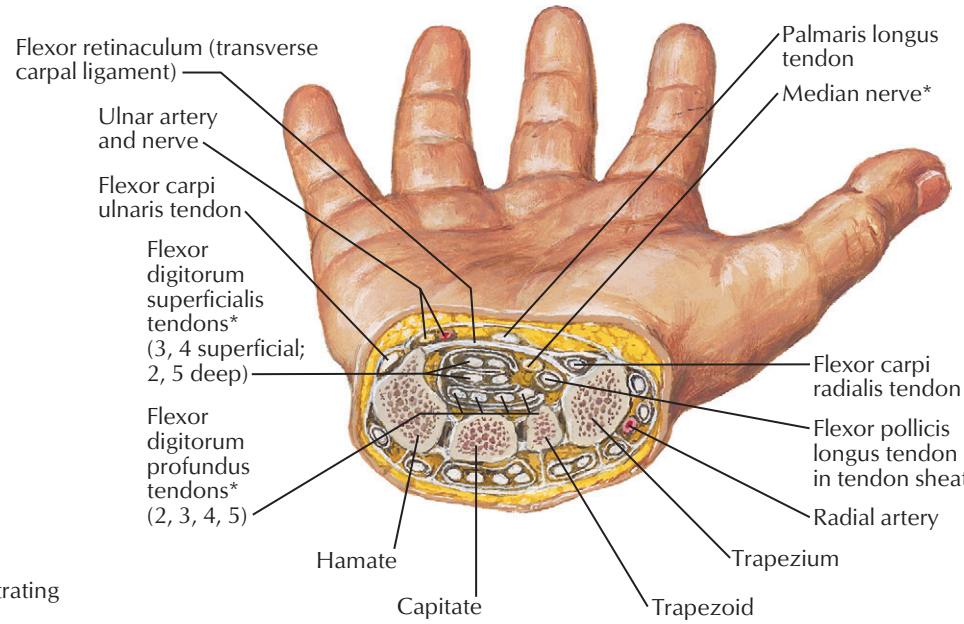
Flexor Tendons, Arteries, and Nerves at Wrist

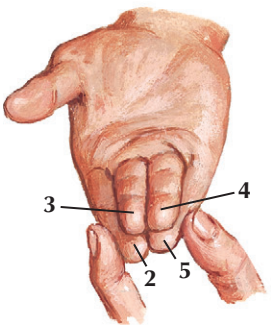
See also Plates 459, 460

Palmar view



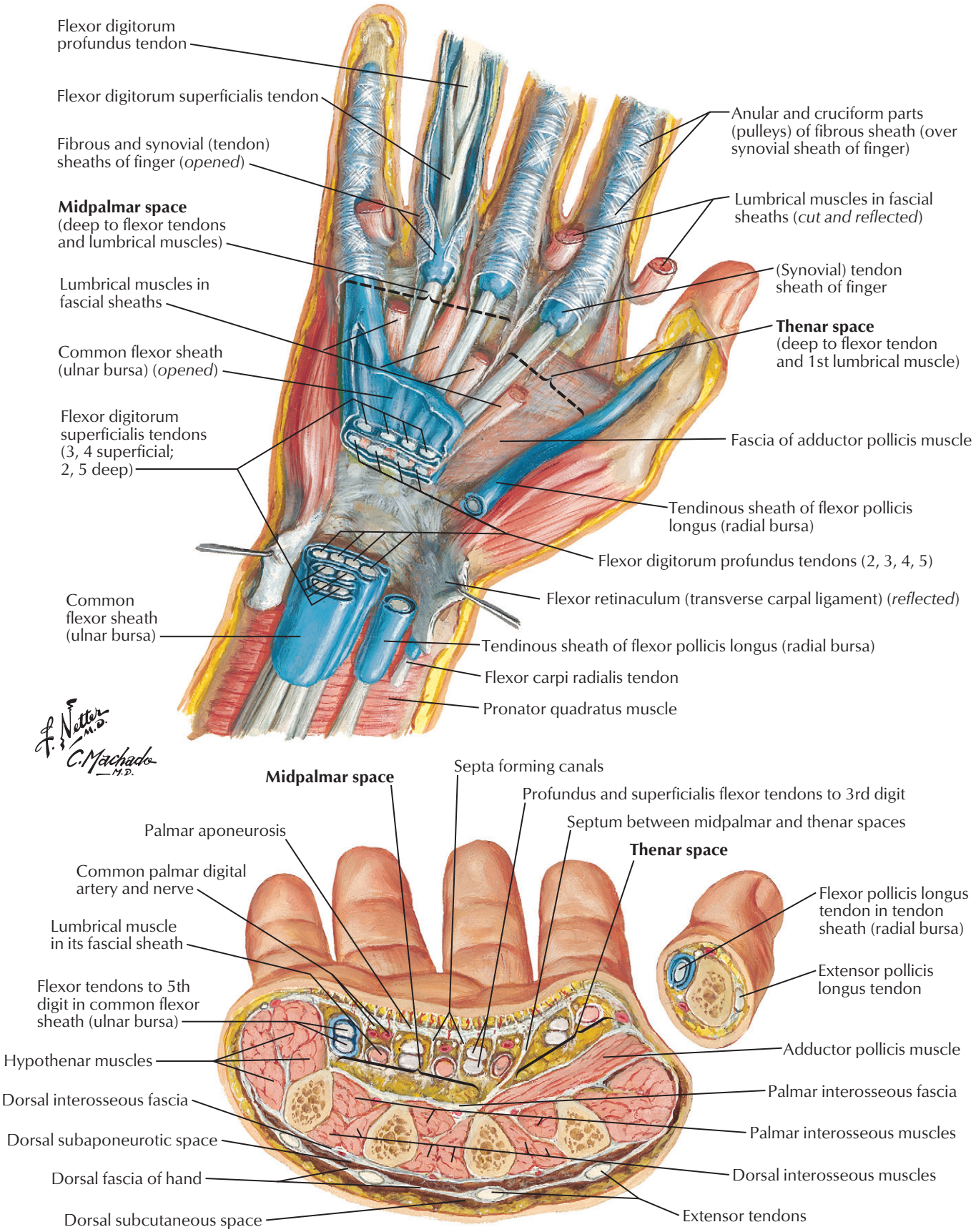
Cross section of wrist demonstrating carpal tunnel





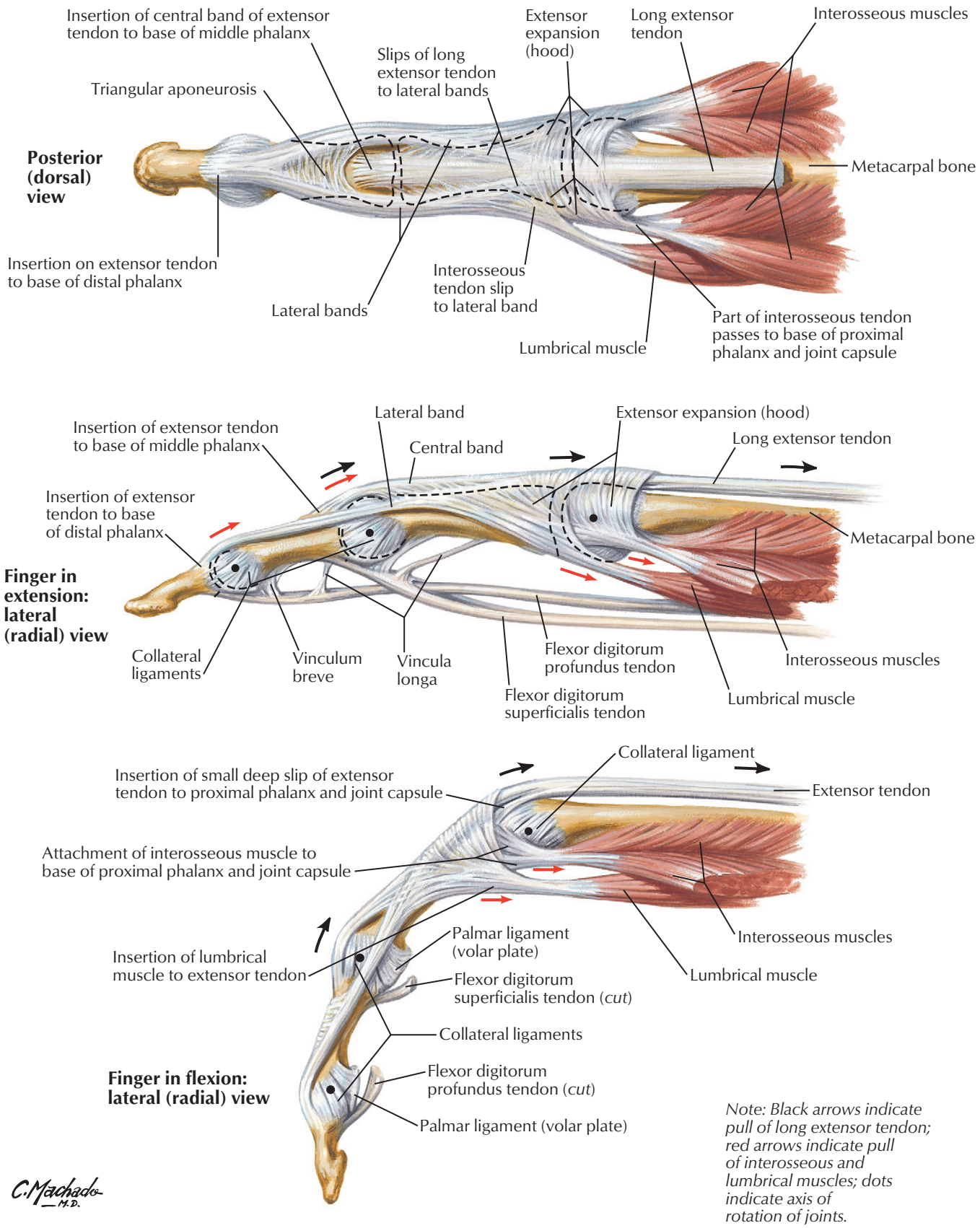
Simple method of demonstrating arrangement of flexor digitorum superficialis tendons within carpal tunnel

*Contents of carpal tunnel


Flexor digitorum profundus tendon
Flexor digitorum superficialis tendon
Fibrous and synovial (tendon) sheaths of finger (*opened*)
Midpalmar space (deep to flexor tendons and lumbrical muscles)
Lumbrical muscles in fascial sheaths
Common flexor sheath (ulnar bursa) (*opened*)
Flexor digitorum superficialis tendons (3, 4 superficial; 2, 5 deep)
Common flexor sheath (ulnar bursa)
Anular and cruciform parts (pulleys) of fibrous sheath (over synovial sheath of finger)
Lumbrical muscles in fascial sheaths (*cut and reflected*)
(Synovial) tendon sheath of finger
Thenar space (deep to flexor tendon and 1st lumbrical muscle)
Fascia of adductor pollicis muscle
Tendinous sheath of flexor pollicis longus (radial bursa)
Flexor digitorum profundus tendons (2, 3, 4, 5)
Flexor retinaculum (transverse carpal ligament) (*reflected*)
Tendinous sheath of flexor pollicis longus (radial bursa)
Flexor carpi radialis tendon
Pronator quadratus muscle
F. Netter M.D.
C. Machado M.D.
Midpalmar space
Septa forming canals
Profundus and superficialis flexor tendons to 3rd digit
Septum between midpalmar and thenar spaces
Thenar space
Palmar aponeurosis
Common palmar digital artery and nerve
Lumbrical muscle in its fascial sheath
Flexor tendons to 5th digit in common flexor sheath (ulnar bursa)
Hypothenar muscles
Dorsal interosseous fascia
Dorsal subaponeurotic space
Dorsal fascia of hand
Dorsal subcutaneous space
Flexor pollicis longus tendon in tendon sheath (radial bursa)
Extensor pollicis longus tendon
Adductor pollicis muscle
Palmar interosseous fascia
Palmar interosseous muscles
Dorsal interosseous muscles
Extensor tendons

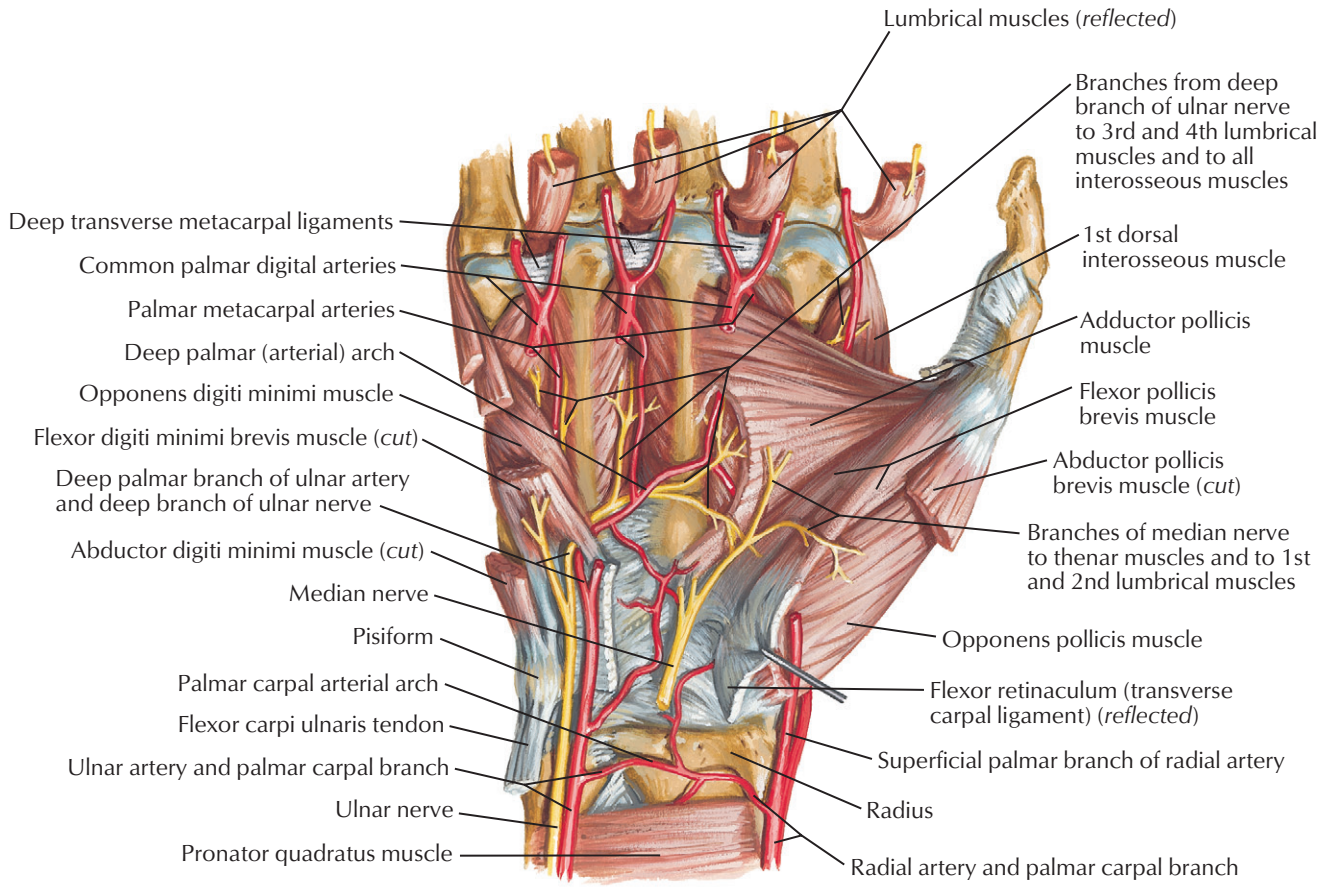
Flexor and Extensor Tendons in Fingers

See also Plate 445

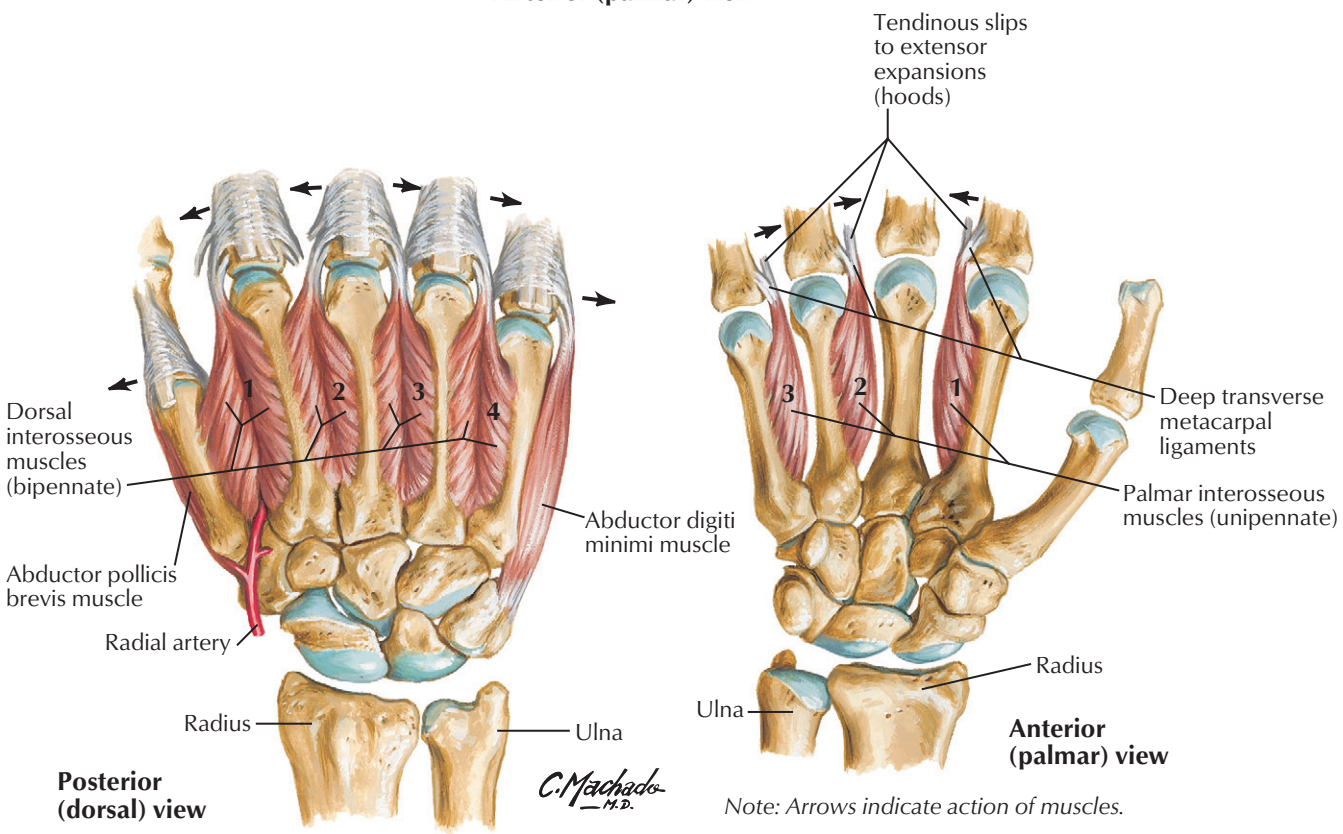


Note: Black arrows indicate pull of long extensor tendon; red arrows indicate pull of interosseous and lumbrical muscles; dots indicate axis of rotation of joints.

C. Machado M.D.



Anterior (palmar) view



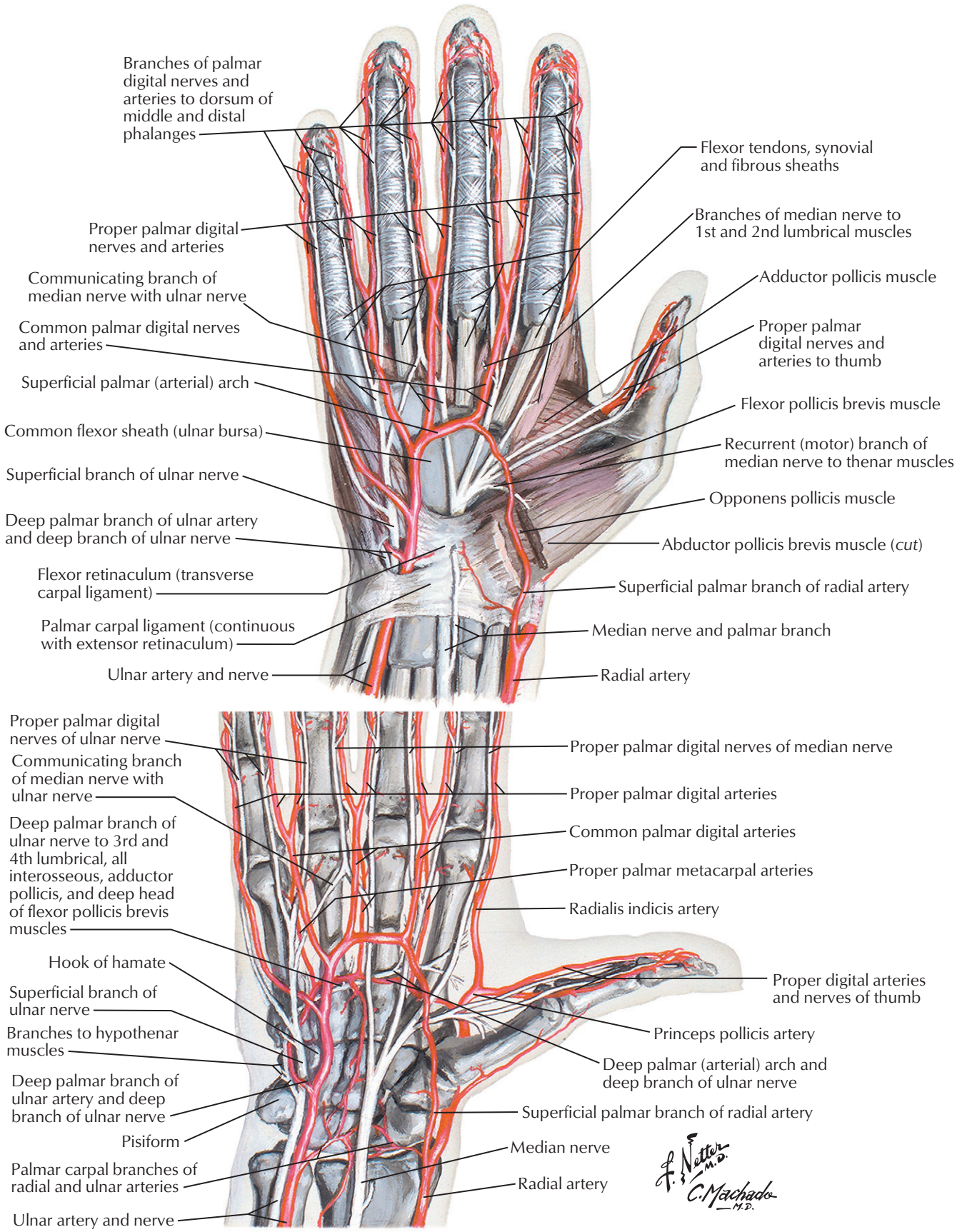
Posterior (dorsal) view

Anterior (palmar) view

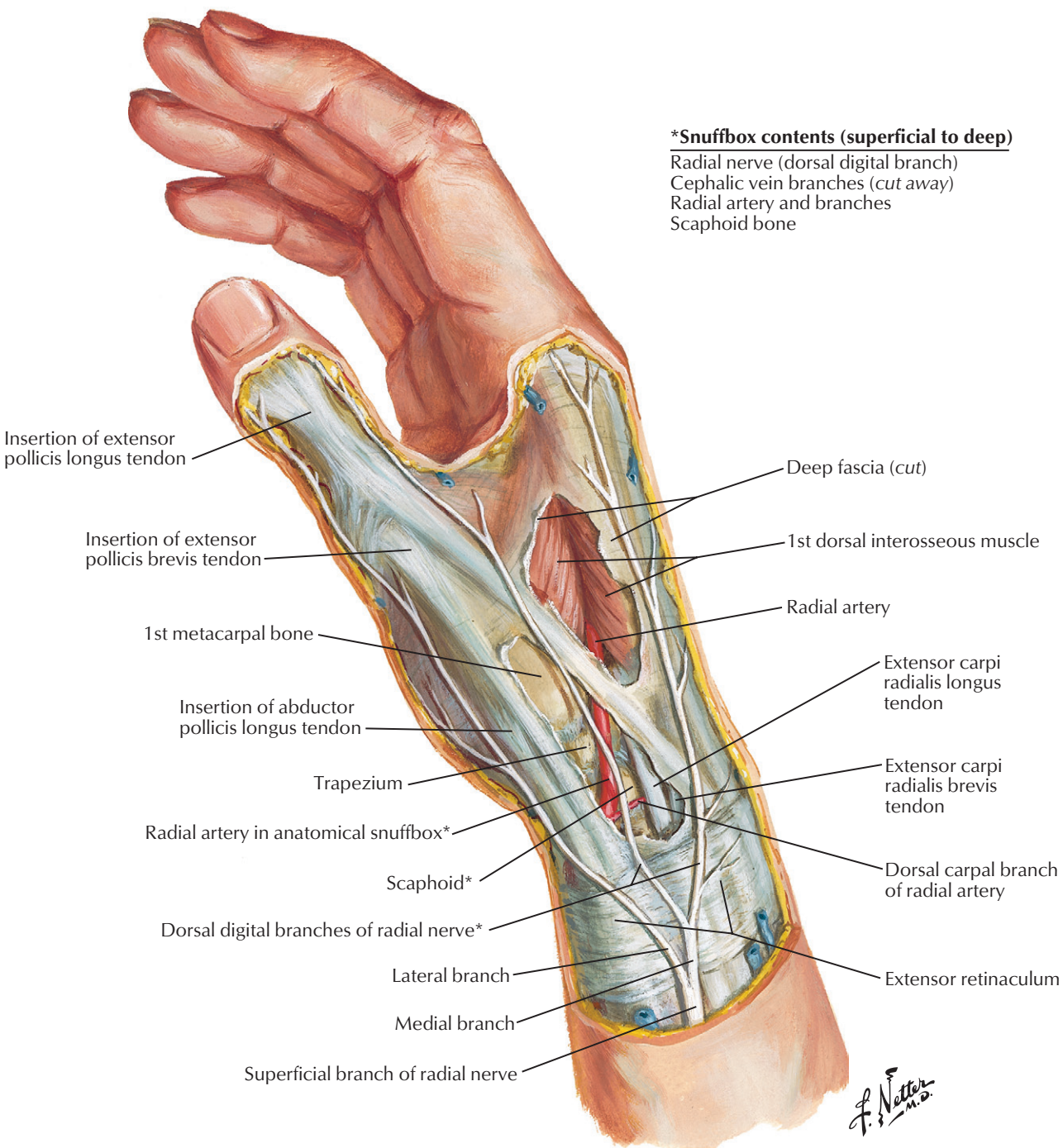
Note: Arrows indicate action of muscles.

Arteries and Nerves of Hand: Palmar Views

See also Plate 420

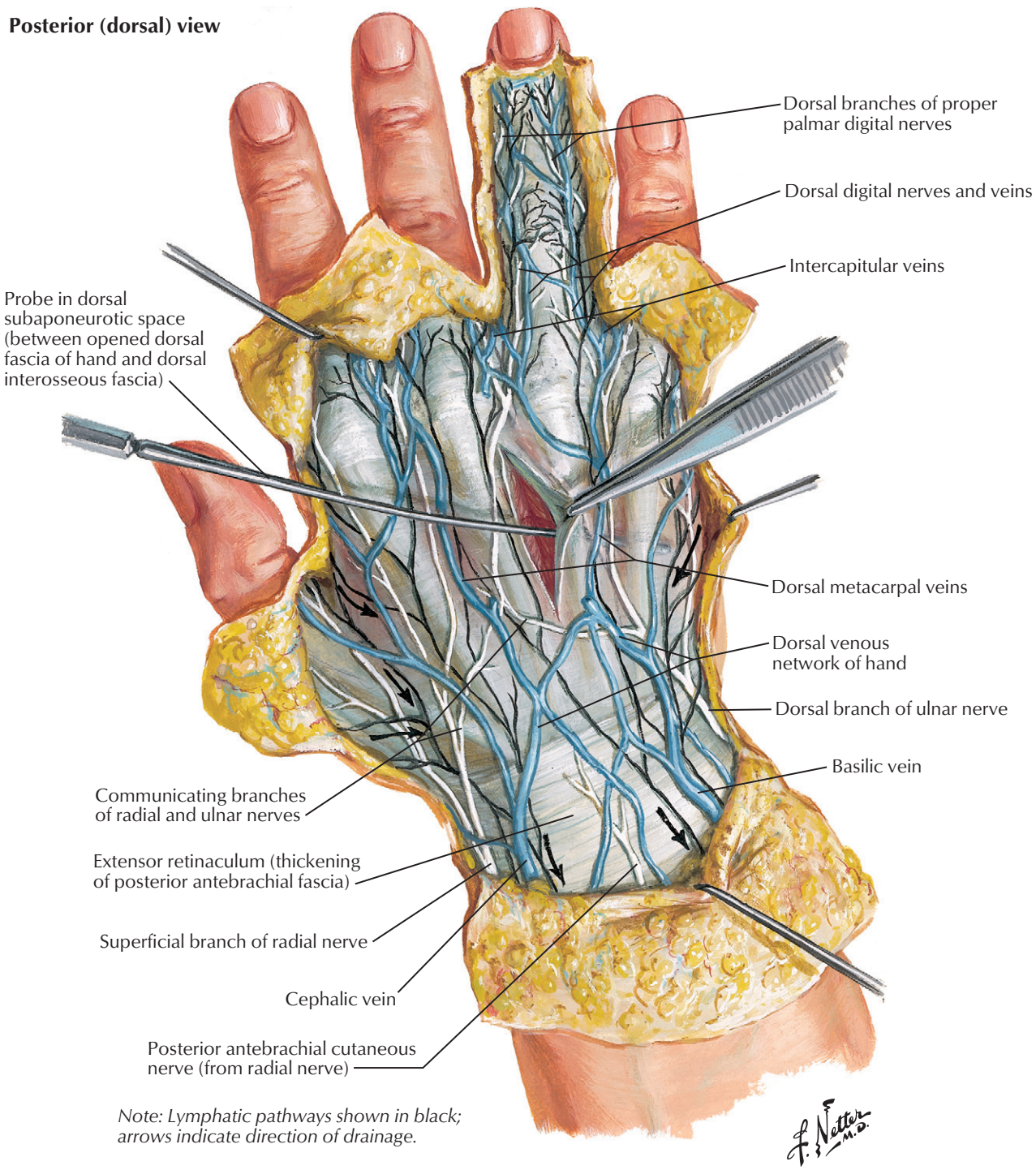


Lateral (radial) view

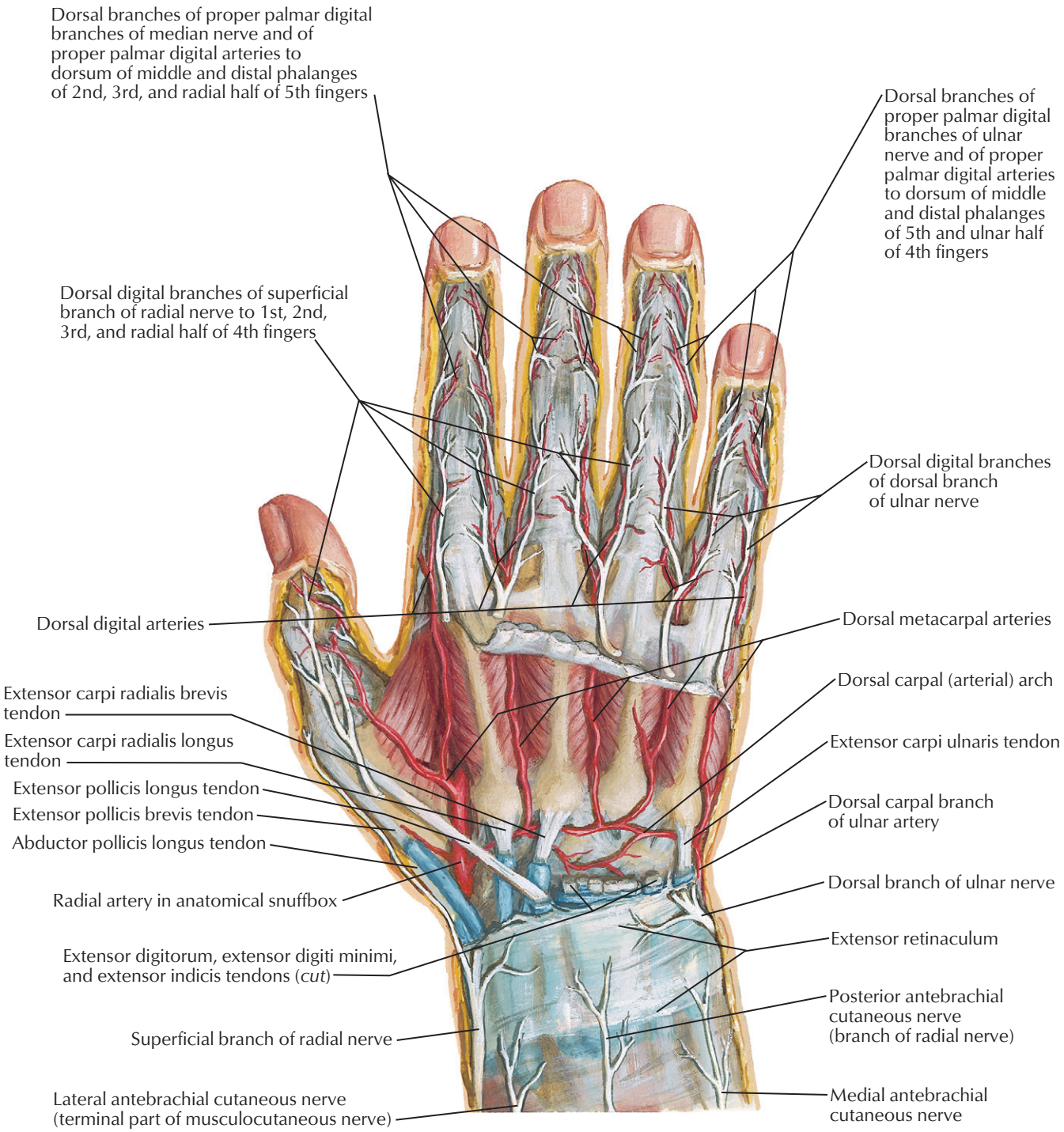


See also Plates 402, 403

Posterior (dorsal) view

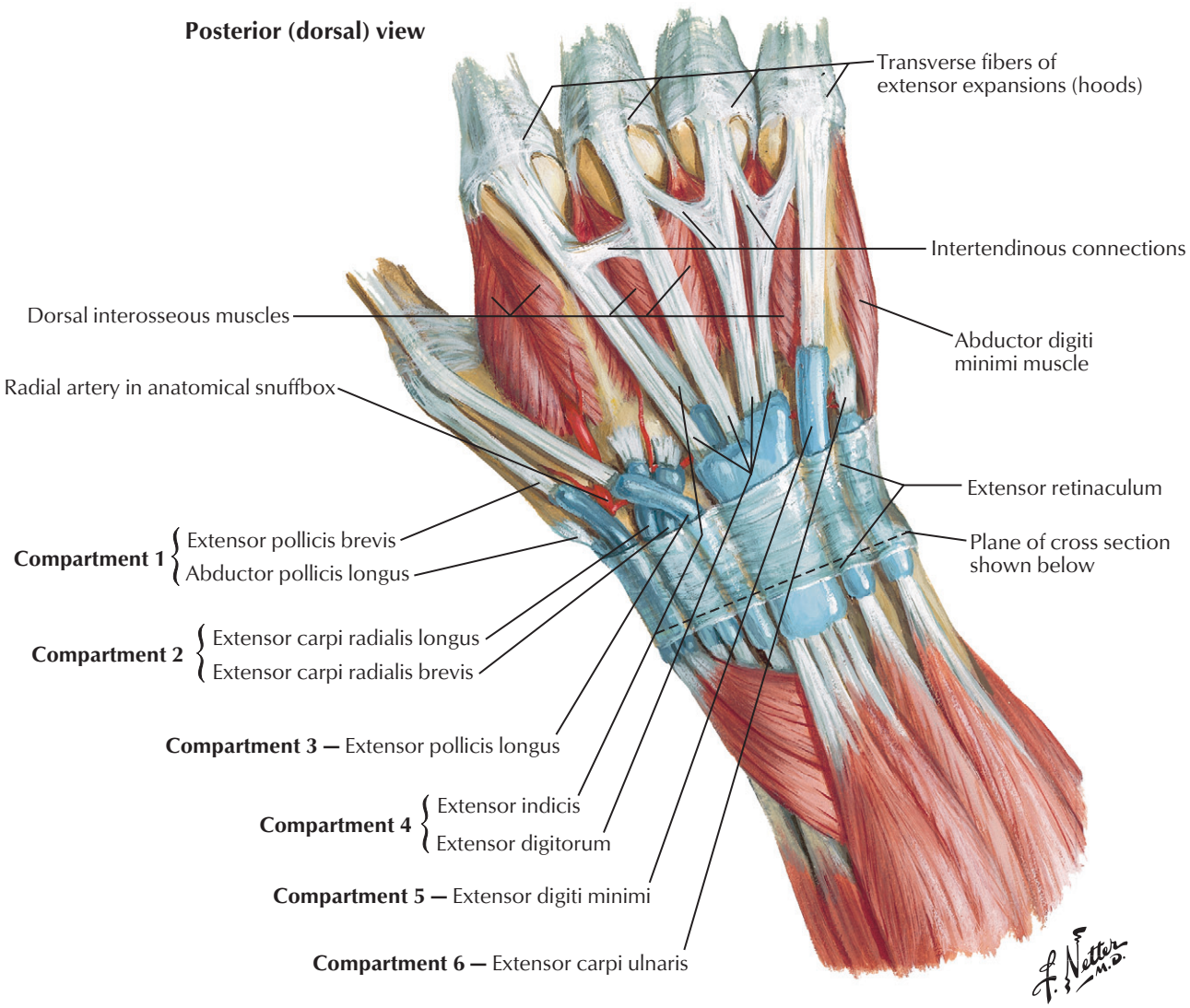


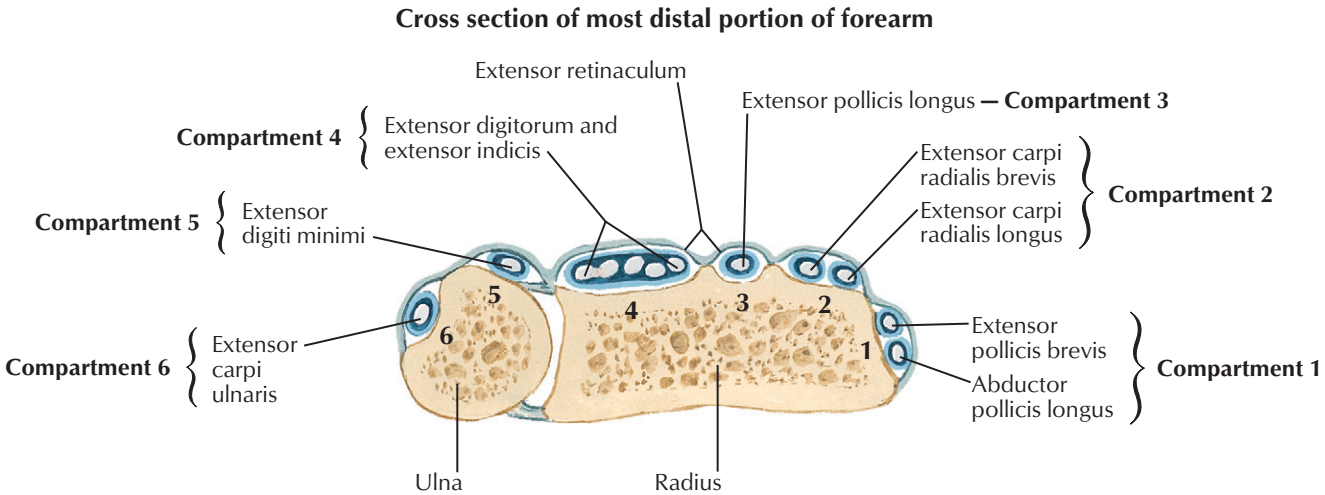
Note: Lymphatic pathways shown in black; arrows indicate direction of drainage.

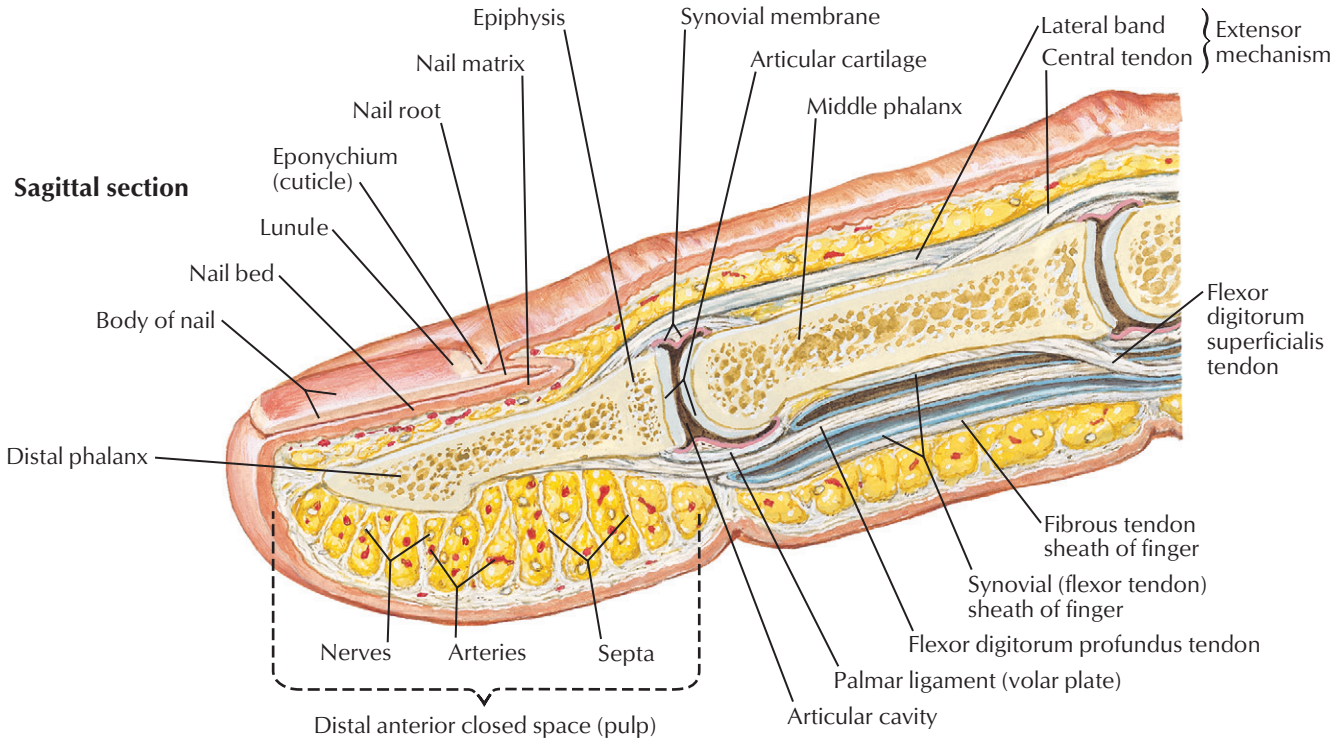


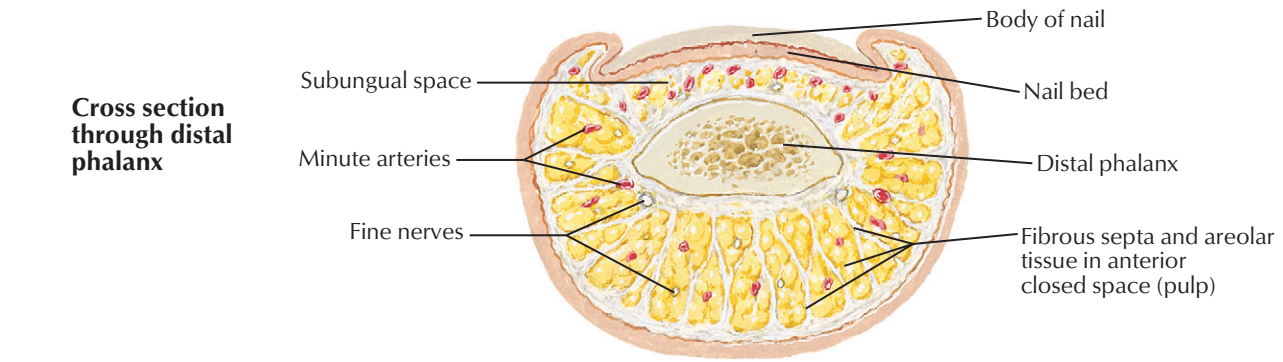
Posterior (dorsal) view

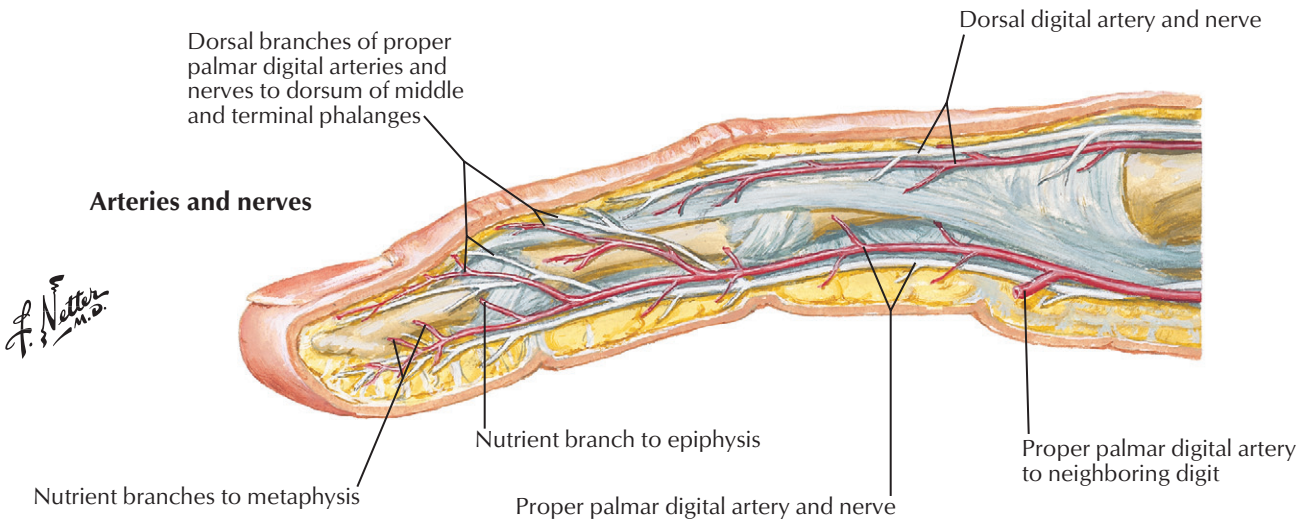
See also Plates 430, 431



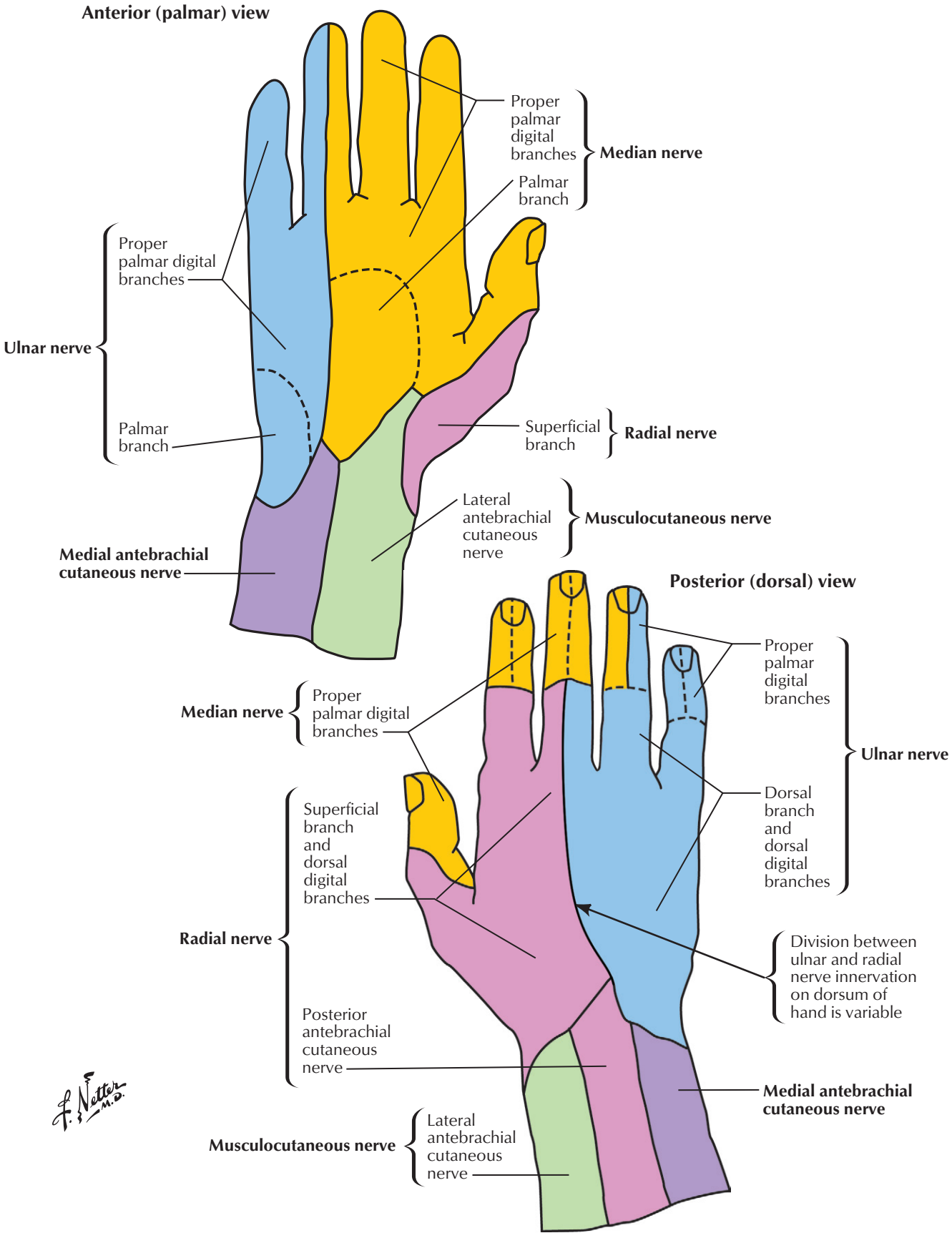



Sagittal section
Epiphysis
Synovial membrane
Lateral band
Extensor mechanism
Central tendon
Nail matrix
Articular cartilage
Nail root
Middle phalanx
Eponychium (cuticle)
Lunule
Nail bed
Body of nail
Flexor digitorum superficialis tendon
Distal phalanx
Fibrous tendon sheath of finger
Synovial (flexor tendon) sheath of finger
Flexor digitorum profundus tendon
Nerves
Arteries
Septa
Palmar ligament (volar plate)
Articular cavity
Distal anterior closed space (pulp)

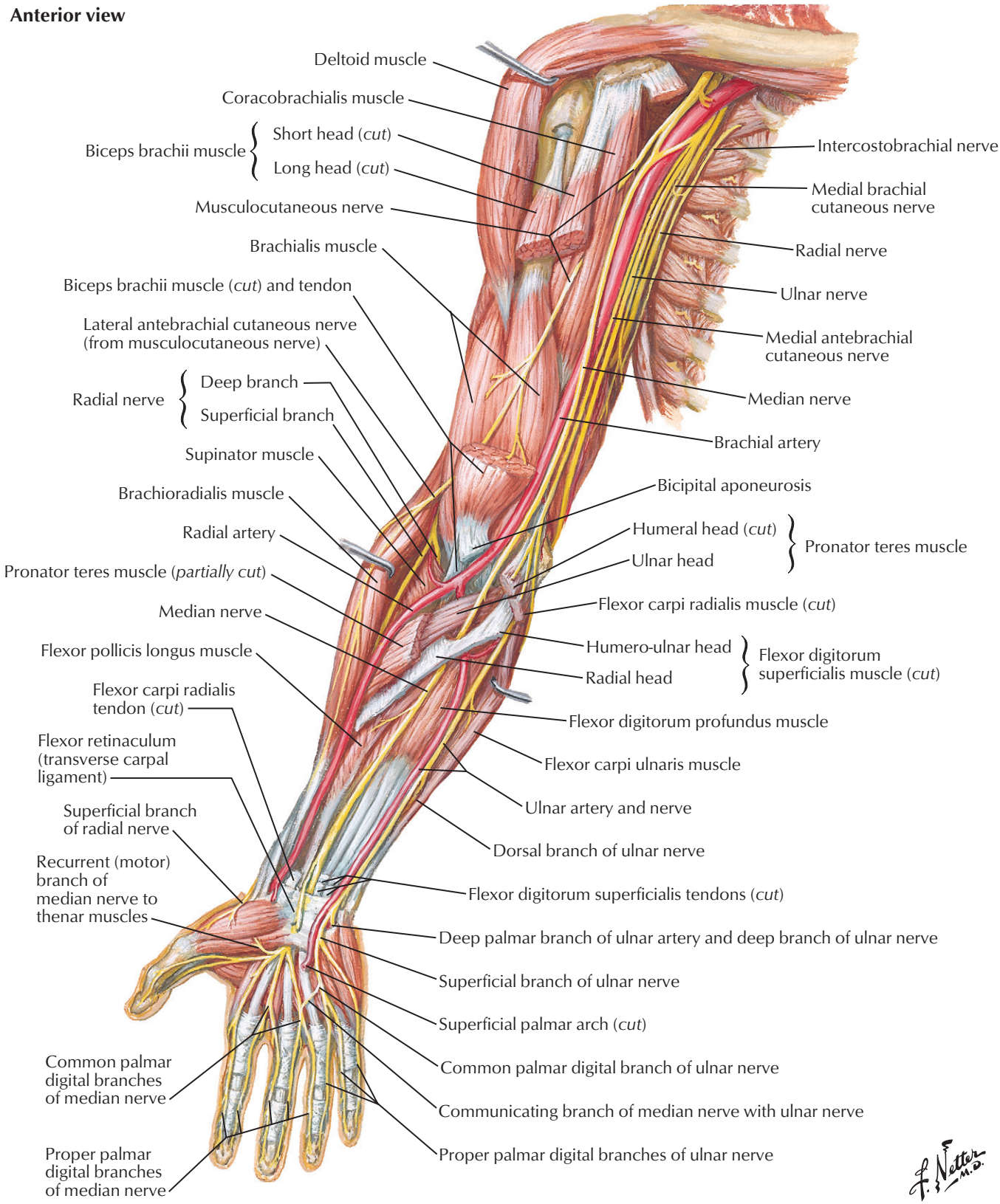

Cross section through distal phalanx
Body of nail
Subungual space
Nail bed
Minute arteries
Distal phalanx
Fine nerves
Fibrous septa and areolar tissue in anterior closed space (pulp)


Arteries and nerves
Dorsal digital artery and nerve
Dorsal branches of proper palmar digital arteries and nerves to dorsum of middle and terminal phalanges
Nutrient branch to epiphysis
Proper palmar digital artery to neighboring digit
Nutrient branches to metaphysis
Proper palmar digital artery and nerve

See also Plates 400, 449

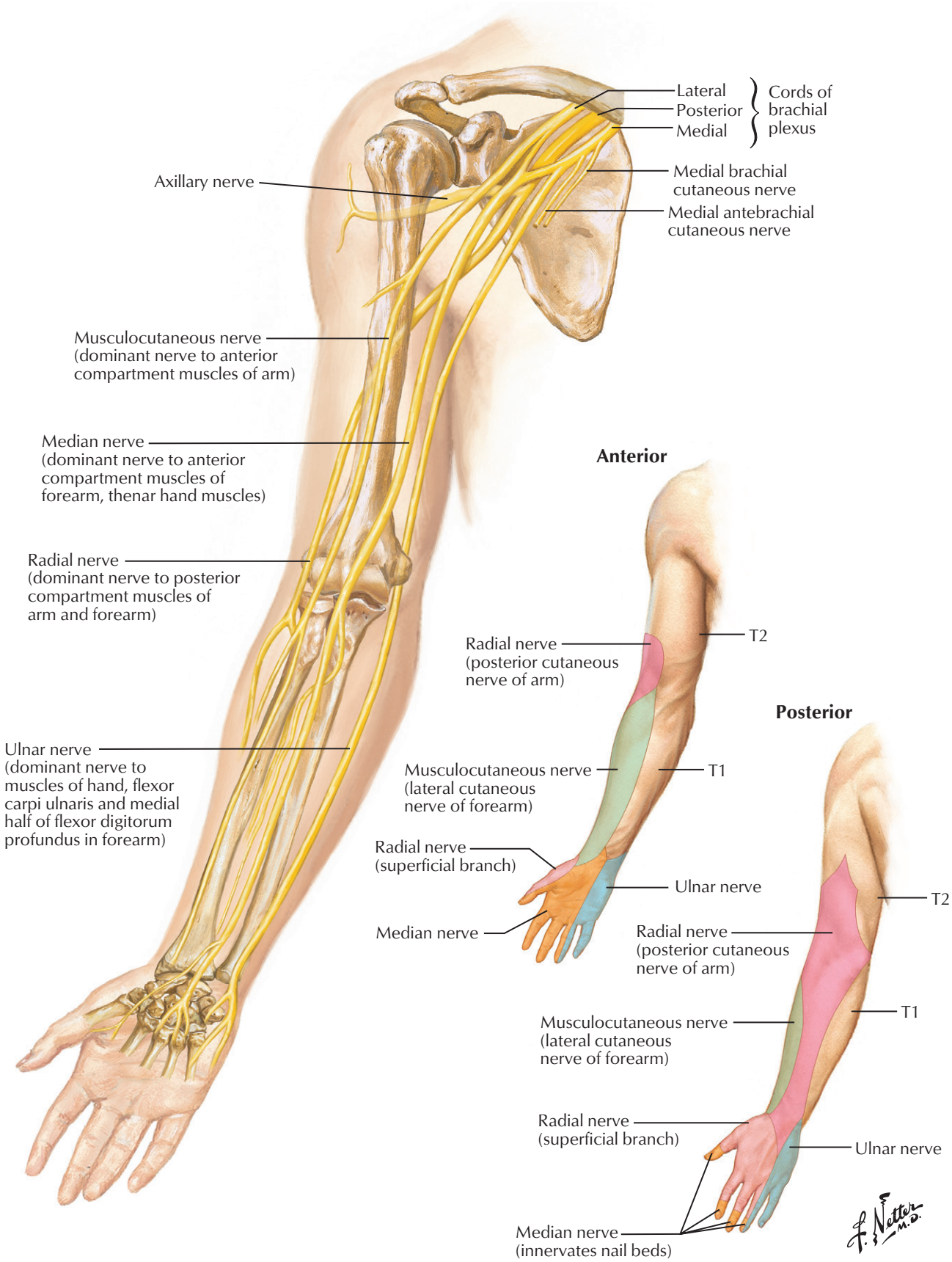


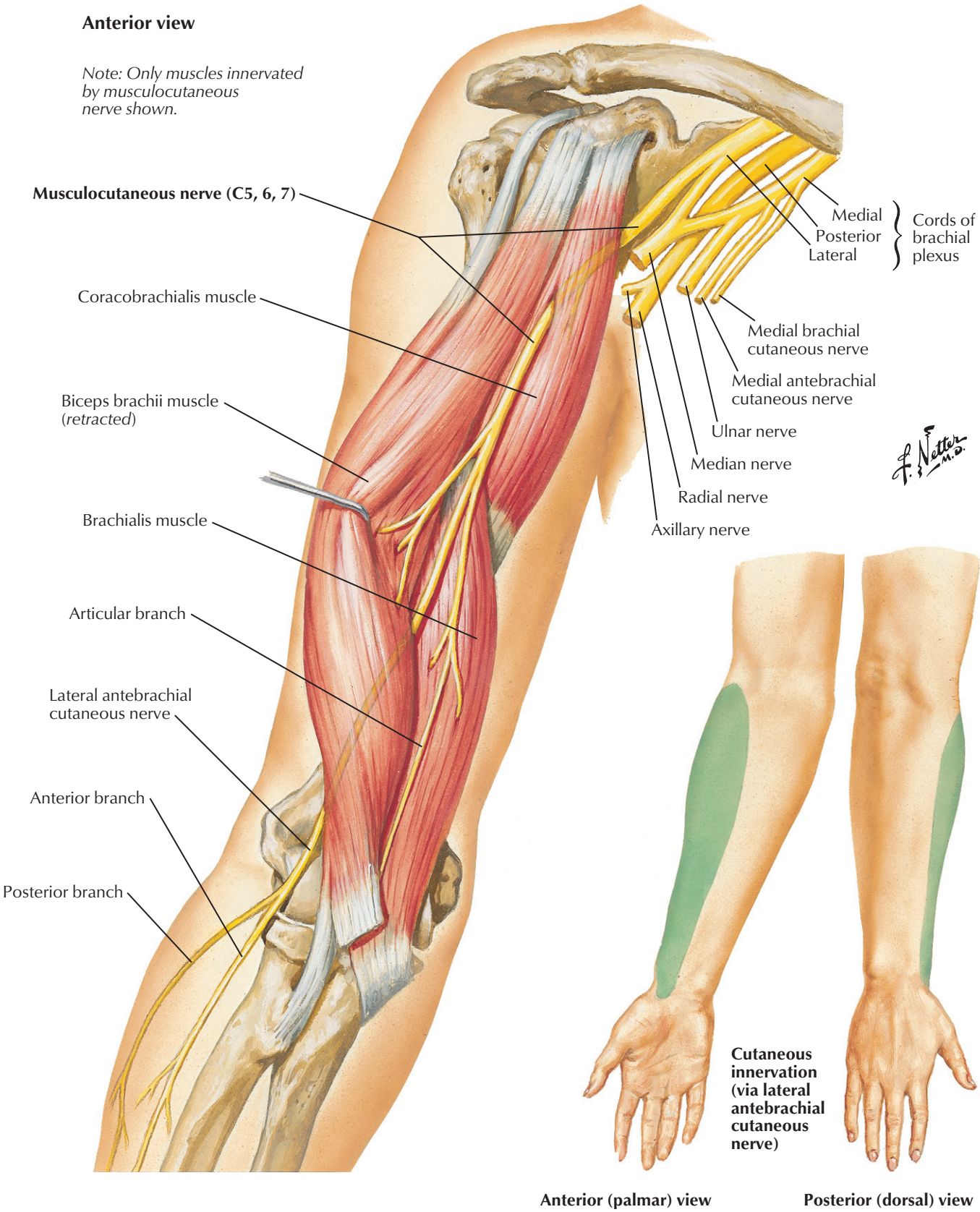
Anterior view



Nerves of Upper Limb

See also **Plates 400, 410, 416**



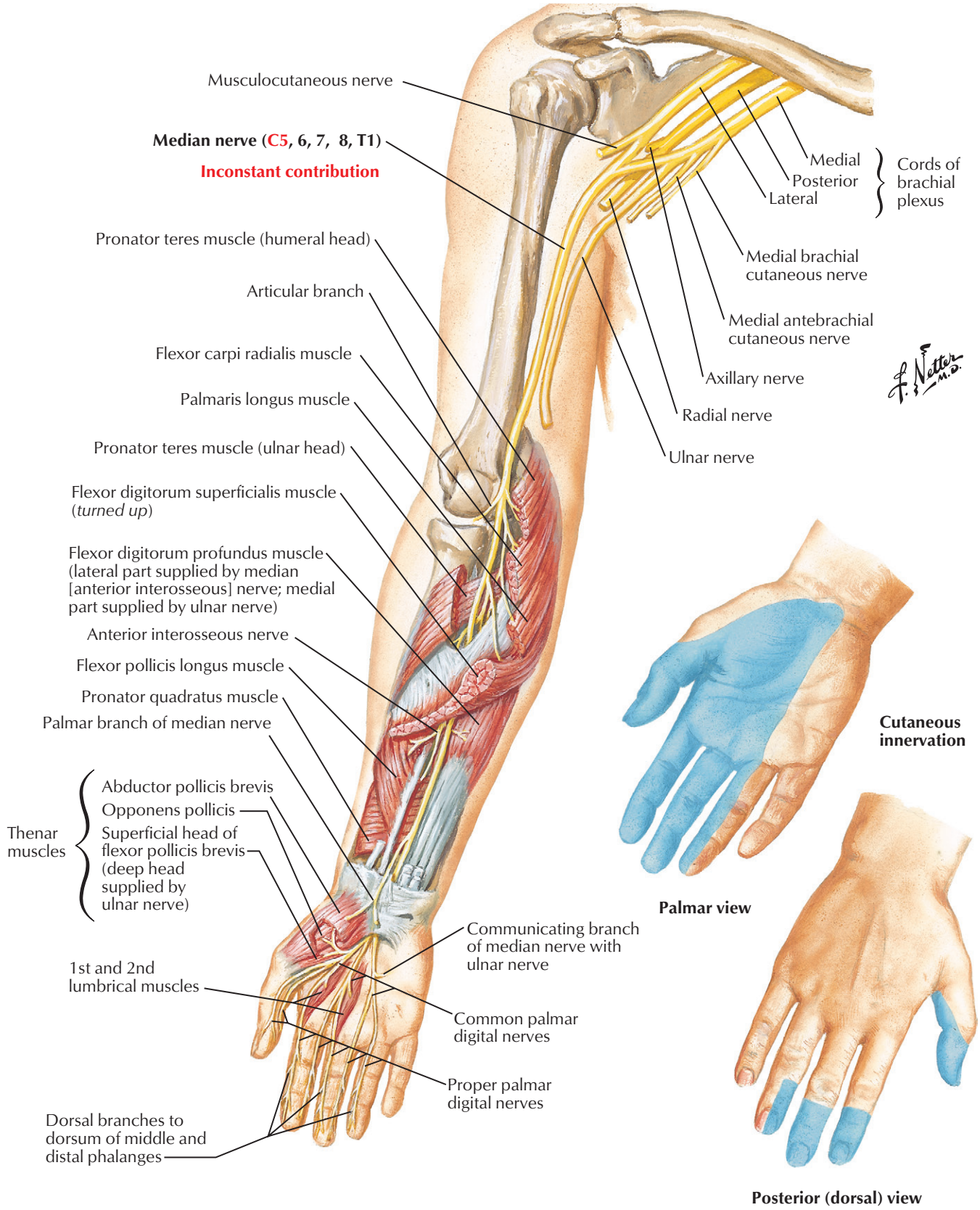

Anterior view
Note: Only muscles innervated by musculocutaneous nerve shown.
Musculocutaneous nerve (C5, 6, 7)
Coracobrachialis muscle
Biceps brachii muscle (retracted)
Brachialis muscle
Articular branch
Lateral antebrachial cutaneous nerve
Anterior branch
Posterior branch
Medial
Posterior
Lateral
Cords of brachial plexus
Medial brachial cutaneous nerve
Medial antebrachial cutaneous nerve
Ulnar nerve
Median nerve
Radial nerve
Axillary nerve
Cutaneous innervation (via lateral antebrachial cutaneous nerve)
Anterior (palmar) view
Posterior (dorsal) view

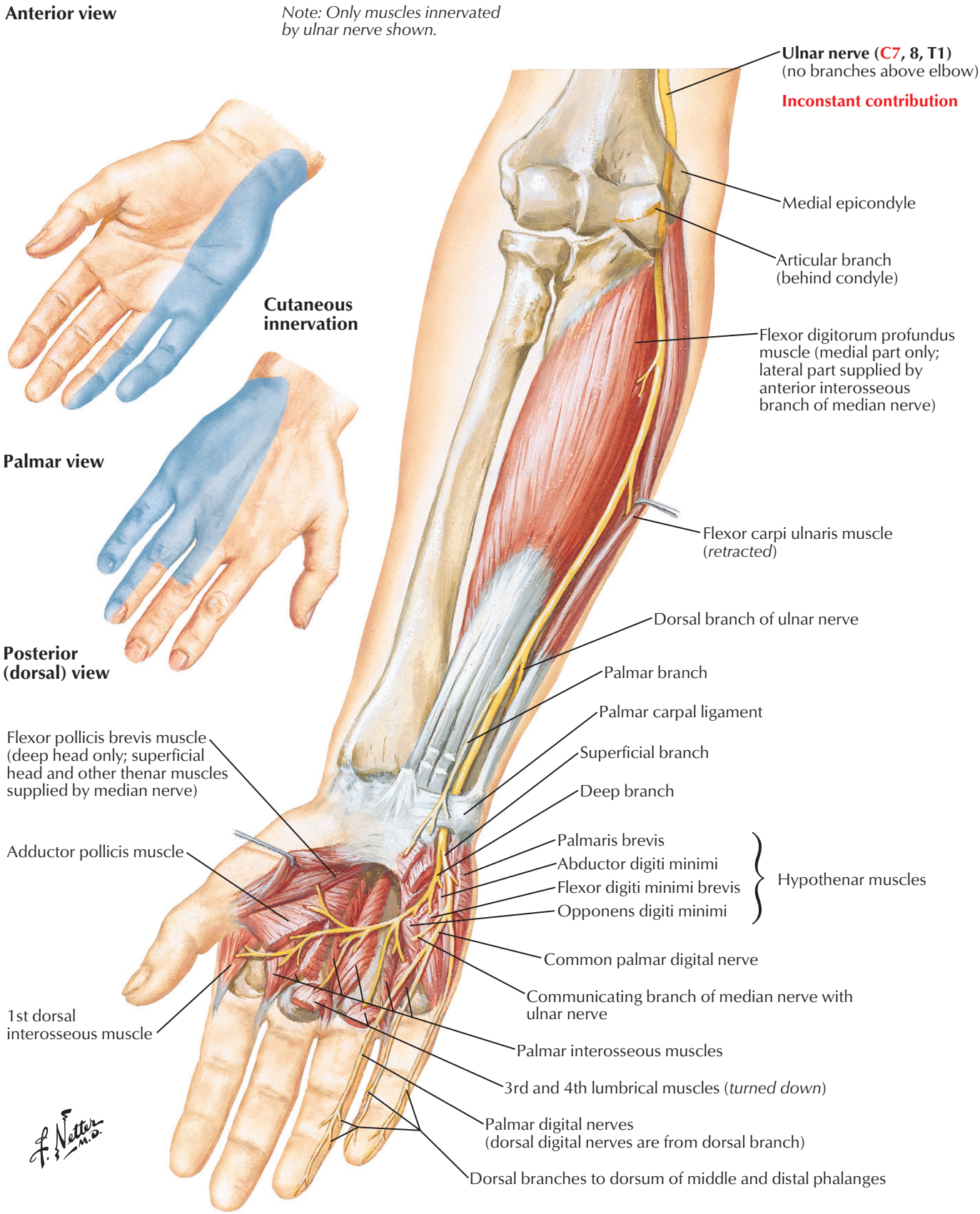
Median Nerve

See also **Plates 400, 432, 433**

Anterior view

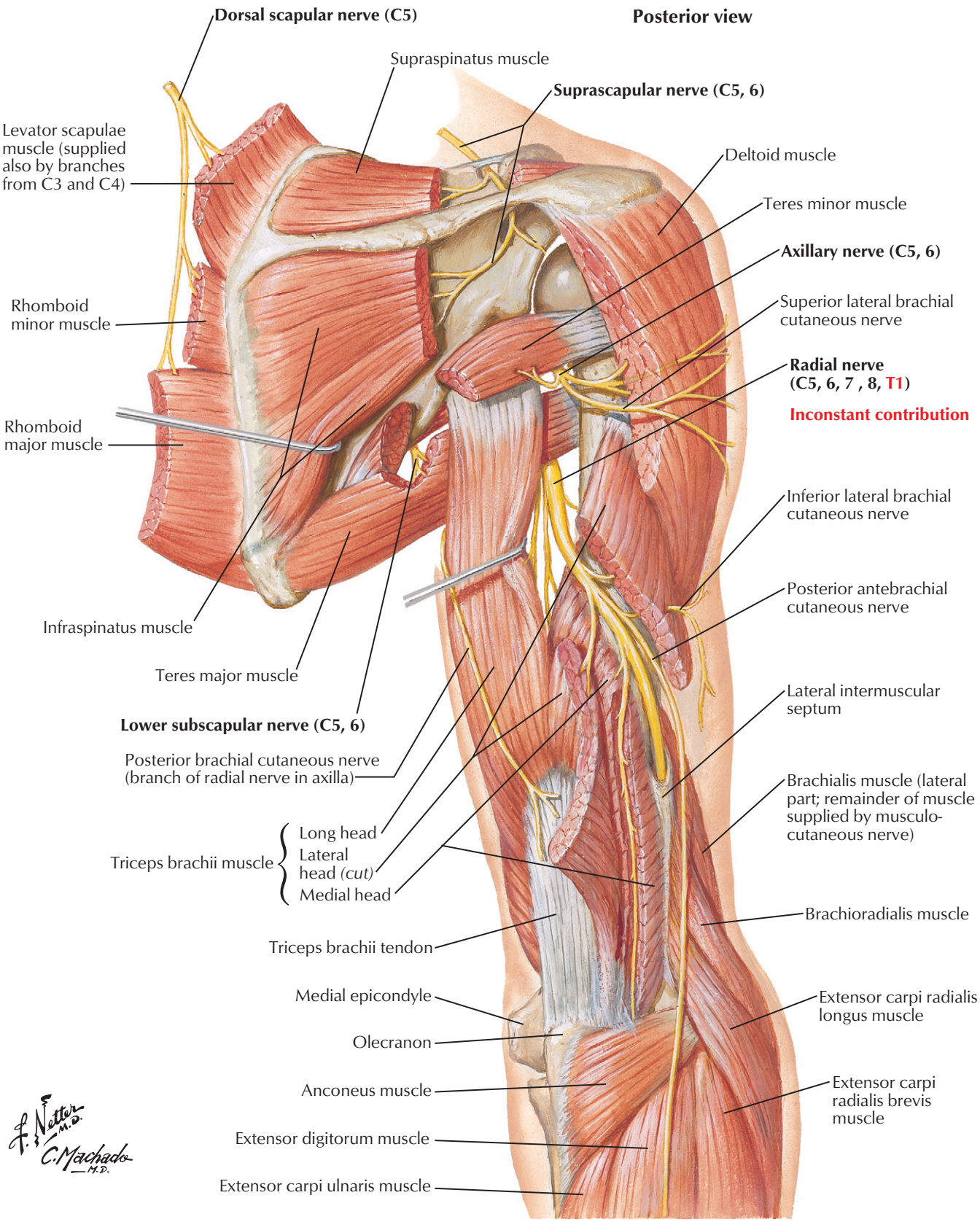
Note: Only muscles innervated by median nerve shown.

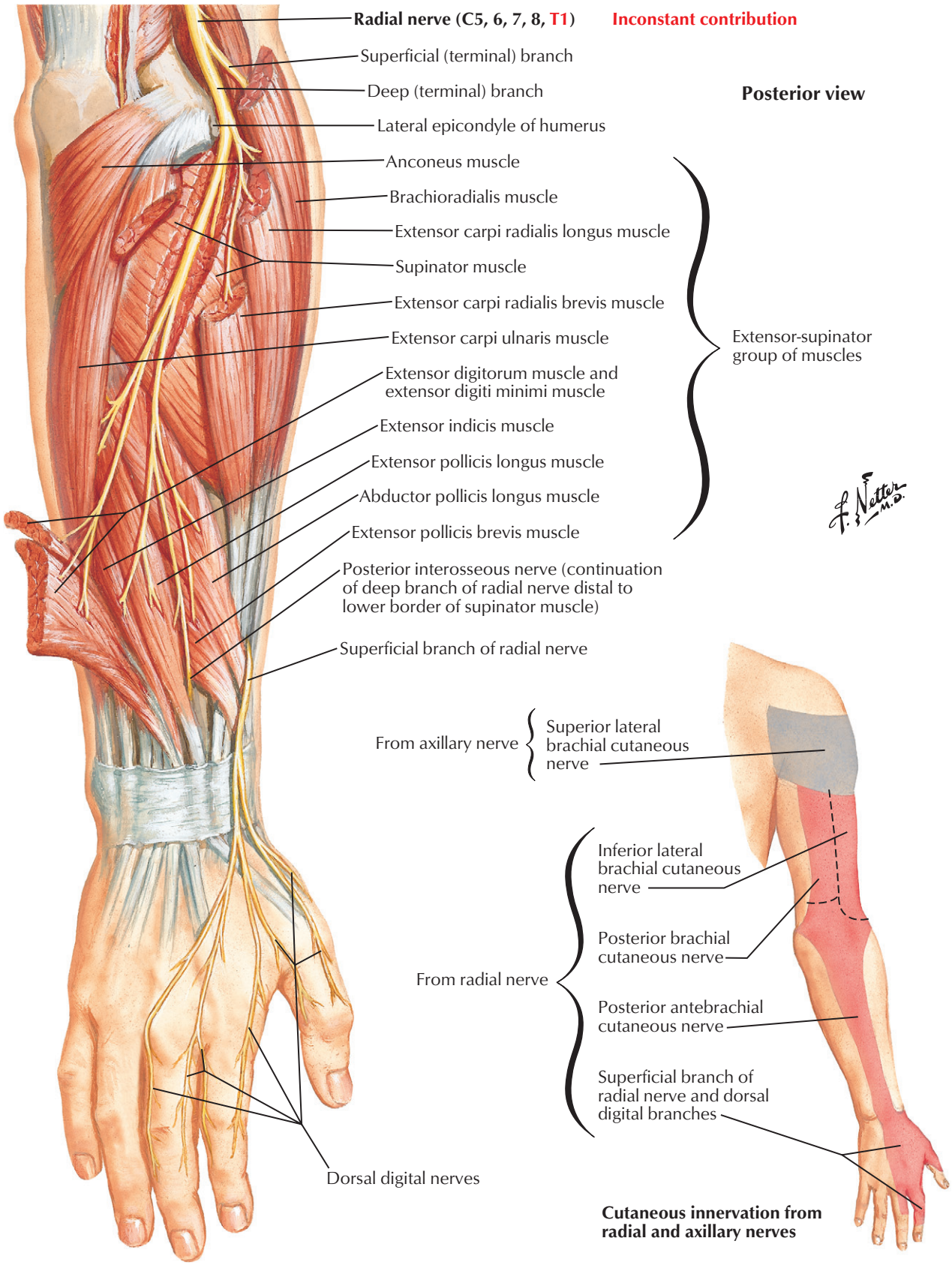



Anterior view
Note: Only muscles innervated by ulnar nerve shown.
Ulnar nerve (C7, 8, T1)
(no branches above elbow)
Inconstant contribution
Medial epicondyle
Articular branch
(behind condyle)
Cutaneous innervation
Flexor digitorum profundus muscle (medial part only; lateral part supplied by anterior interosseous branch of median nerve)
Palmar view
Flexor carpi ulnaris muscle (retracted)
Dorsal branch of ulnar nerve
Posterior (dorsal) view
Palmar branch
Palmar carpal ligament
Flexor pollicis brevis muscle (deep head only; superficial head and other thenar muscles supplied by median nerve)
Superficial branch
Deep branch
Adductor pollicis muscle
Palmaris brevis
Abductor digiti minimi
Flexor digiti minimi brevis
Opponens digiti minimi
Hypothenar muscles
Common palmar digital nerve
Communicating branch of median nerve with ulnar nerve
1st dorsal interosseous muscle
Palmar interosseous muscles
3rd and 4th lumbrical muscles (turned down)
Palmar digital nerves (dorsal digital nerves are from dorsal branch)
Dorsal branches to dorsum of middle and distal phalanges

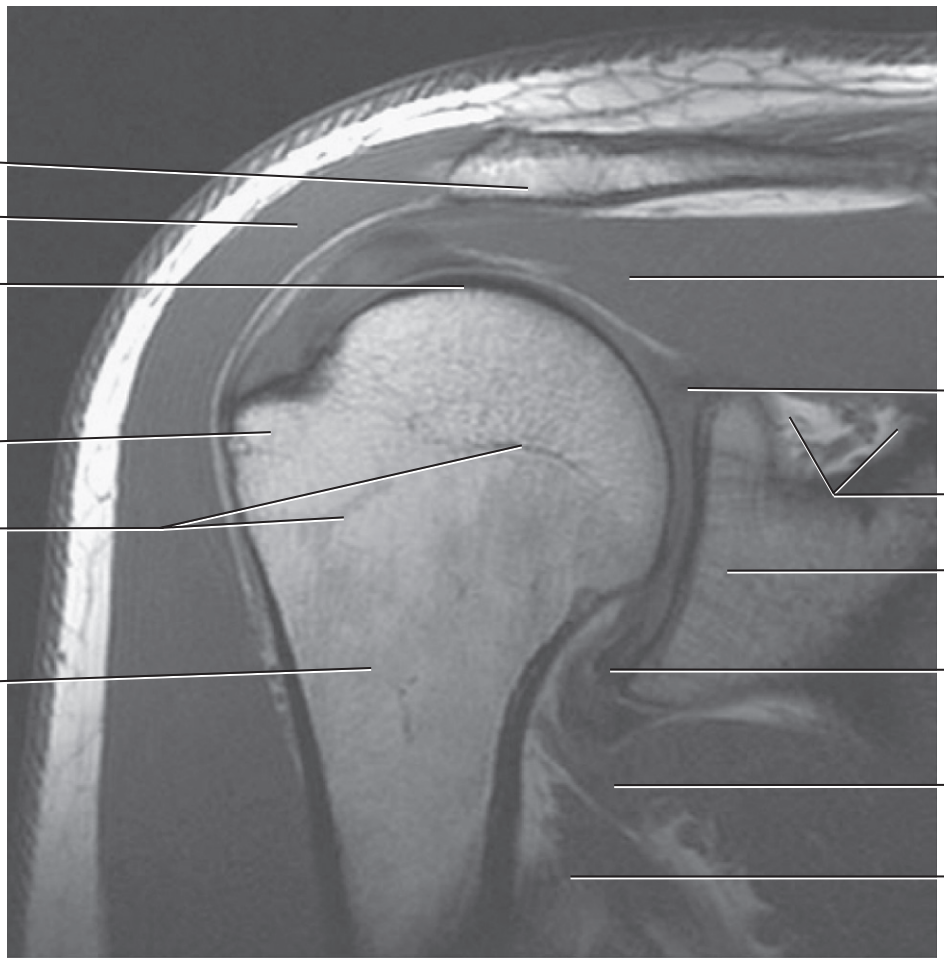
Radial Nerve in Arm and Nerves of Posterior Shoulder

See also Plates 413, 418

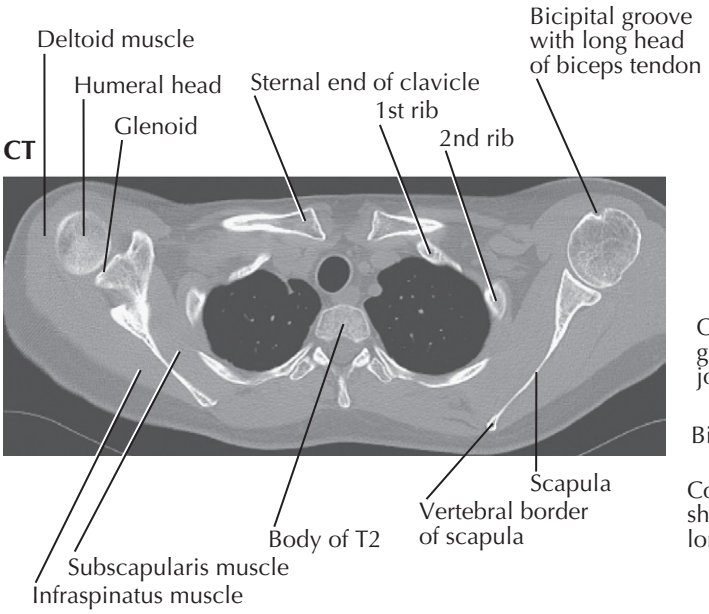



Radial nerve (C5, 6, 7, 8, T1)
Inconstant contribution
Superficial (terminal) branch
Deep (terminal) branch
Posterior view
Lateral epicondyle of humerus
Anconeus muscle
Brachioradialis muscle
Extensor carpi radialis longus muscle
Supinator muscle
Extensor carpi radialis brevis muscle
Extensor carpi ulnaris muscle
Extensor digitorum muscle and extensor digiti minimi muscle
Extensor indicis muscle
Extensor pollicis longus muscle
Abductor pollicis longus muscle
Extensor pollicis brevis muscle
Posterior interosseous nerve (continuation of deep branch of radial nerve distal to lower border of supinator muscle)
Superficial branch of radial nerve
Extensor-supinator group of muscles
F. Netter M.D.
From axillary nerve
Superior lateral brachial cutaneous nerve
Inferior lateral brachial cutaneous nerve
From radial nerve
Posterior brachial cutaneous nerve
Posterior antebrachial cutaneous nerve
Superficial branch of radial nerve and dorsal digital branches
Dorsal digital nerves
Cutaneous innervation from radial and axillary nerves

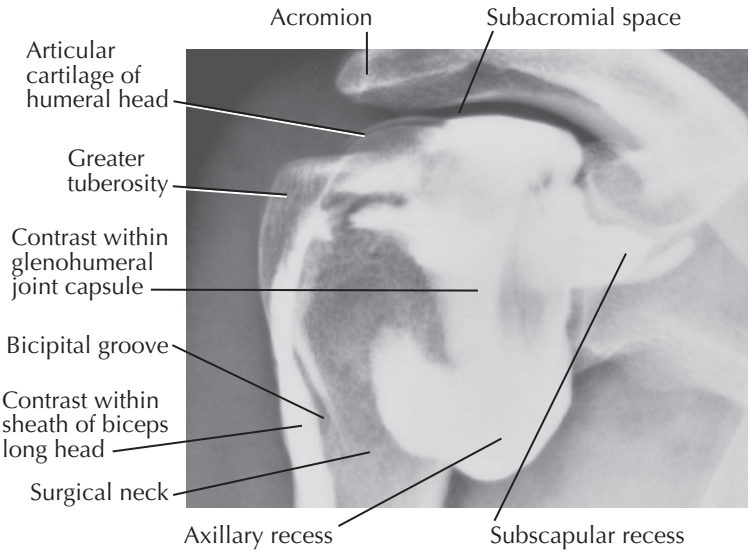
MRI



CT



Arthrogram: glenohumeral joint



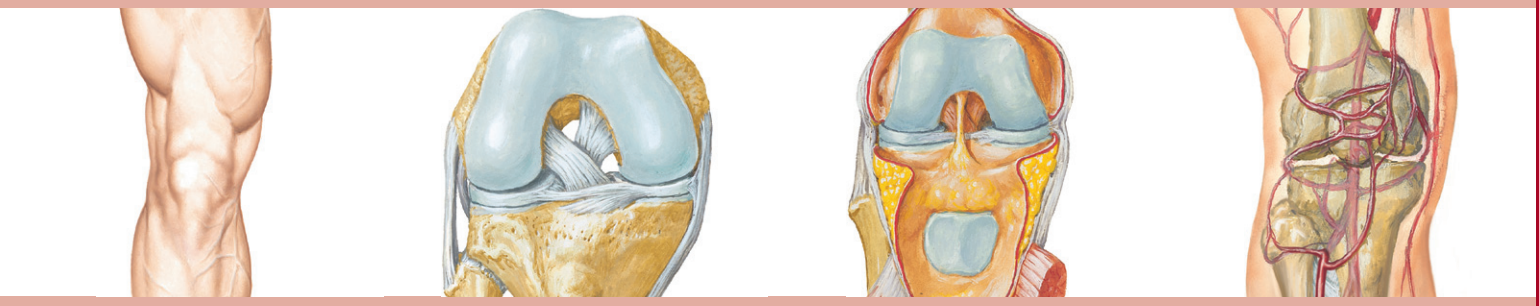
MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Abductor digiti minimi	Pisiform bone and tendon of flexor carpi ulnaris	Medial side of base of proximal phalanx of little finger (5th digit)	Ulnar nerve (deep branch)	Abducts little finger	Deep palmar branch of ulnar artery	Hand
Abductor pollicis brevis	Flexor retinaculum, tubercles of scaphoid and trapezium	Lateral side of base of proximal phalanx of thumb	Median nerve (recurrent branch)	Abducts thumb	Superficial palmar branch of radial artery	Hand
Abductor pollicis longus	Posterior surface of ulna, radius, and interosseous membrane	Base of 1st metacarpal	Radial nerve (posterior interosseous)	Abducts and extends thumb at carpometacarpal joint	Posterior interosseous artery	Posterior forearm
Adductor pollicis	*Oblique head*: bases of 2nd and 3rd metacarpals and capitate and adjacent bones *Transverse head:* anterior surface of 3rd metacarpal	Medial side of base of proximal phalanx of thumb	Ulnar nerve (deep branch)	Adducts thumb	Deep palmar arch	Hand
Anconeus	Posterior surface of lateral epicondyle of humerus	Lateral surface of olecranon and posterior proximal ulna	Radial nerve (C5–T1)	Assists triceps in extending elbow, abducts ulna in pronation	Deep brachial artery	Arm
Biceps brachii	*Long head:* supraglenoid tubercle of scapula *Short head:* tip of coracoid process of scapula	Radial tuberosity, fascia of forearm via bicipital aponeurosis	Musculocutaneous nerve (C5,C6)	Flexes and supinates forearm at elbow	Muscular branches of brachial artery	Arm
Brachialis	Distal half of anterior surface of humerus	Coronoid process and tuberosity of ulna	Musculocutaneous nerve and radial nerve (C7)	Flexes forearm at elbow	Radial recurrent artery, muscular branches of brachial artery	Arm
Brachioradialis	Proximal 2/3 of lateral supracondylar ridge of humerus	Lateral side of distal end of radius	Radial nerve	Weak flexion of forearm when forearm is midpronated	Radial recurrent artery	Posterior forearm
Coracobrachialis	Tip of coracoid process of scapula	Middle third of medial surface of humerus	Musculocutaneous nerve	Flexes and adducts arm at shoulder	Muscular branches of brachial artery	Arm
Deltoid	Lateral third of anterior clavicle, lateral acromion, inferior edge of spine of scapula	Deltoid tuberosity of humerus	Axillary nerve	*Clavicular part*: flexes and medially rotates arm *Acromial part:* abducts arm beyond initial 15 degrees done by supraspinatus *Spinal part:* extends and laterally rotates arm	Posterior circumflex humeral artery, deltoid branch of thoraco-acromial artery	Shoulder
Dorsal interosseous muscles	Adjacent sides of two metacarpal bones	Base of proximal phalanges, extensor expansion of digits 2–4	Ulnar nerve (deep branch)	Abduct digits from axial line of hand (3rd digit); flex digits at metacarpophalangeal joint and extend interphalangeal joints	Deep palmar arch	Hand
Extensor carpi radialis brevis	Lateral epicondyle of humerus	Dorsal base of 3rd metacarpal and slip to 2nd metacarpal	Radial nerve (deep branch)	Extends and abducts hand at wrist	Radial artery, radial recurrent artery	Posterior forearm
Extensor carpi radialis longus	Distal third of lateral supracondylar ridge of humerus	Dorsal base of 2nd metacarpal and slip to 3rd metacarpal	Radial nerve	Extends and abducts hand at wrist	Radial artery, radial recurrent artery	Posterior forearm

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Extensor carpi ulnaris	Lateral epicondyle of humerus and posterior border of ulna	Dorsal base of 5th metacarpal	Radial nerve (posterior interosseous)	Extends and adducts hand at wrist	Posterior interosseous artery	Posterior forearm
Extensor digiti minimi	Lateral epicondyle of humerus	Extensor expansion of 5th digit	Radial nerve (posterior interosseous)	Extends 5th digit	Posterior interosseous artery	Posterior forearm
Extensor digitorum	Lateral epicondyle of humerus	Extensor expansions of medial four digits	Radial nerve (posterior interosseous)	Extends medial four digits, assists in wrist extension	Posterior interosseous artery	Posterior forearm
Extensor indicis	Posterior surface of ulna and interosseous membrane	Extensor expansion of 2nd digit	Radial nerve (posterior interosseous)	Extends 2nd digit and helps extend hand at wrist	Posterior interosseous artery	Posterior forearm
Extensor pollicis brevis	Posterior surface of radius and interosseous membrane	Dorsal base of proximal phalanx of thumb	Radial nerve (posterior interosseous)	Extends proximal phalanx of thumb at carpometacarpal joint	Posterior interosseous artery	Posterior forearm
Extensor pollicis longus	Posterior surface of middle third of ulna, interosseous membrane	Dorsal base of distal phalanx of thumb	Radial nerve (posterior interosseous)	Extends distal phalanx of thumb at interphalangeal and metacarpophalangeal joints	Posterior interosseous artery	Posterior forearm
Flexor carpi radialis	Medial epicondyle of humerus	Base of 2nd metacarpal	Median nerve	Flexes and abducts hand at wrist	Radial artery	Anterior forearm
Flexor carpi ulnaris	*Humeral head:* medial epicondyle of humerus *Ulnar head:* olecranon and posterior border of ulna	Pisiform bone, hook of hamate, base of 5th metacarpal	Ulnar nerve	Flexes and adducts hand at wrist	Posterior ulnar recurrent artery	Anterior forearm
Flexor digiti minimi brevis	Flexor retinaculum and hook of hamate bone	Medial side of base of proximal phalanx of little finger	Ulnar nerve (deep branch)	Flexes proximal phalanx of little finger	Deep palmar branch of ulnar artery	Hand
Flexor digitorum profundus	Medial and anterior surface of proximal 3/4 of ulna and interosseous membrane	Palmar base of distal phalanges of medial four digits	*Medial part:* ulnar nerve *Lateral part:* median nerve	Flexes distal phalanges of medial four digits, assists with flexion of hand at wrist	Anterior interosseous artery, muscular branches of ulnar artery	Anterior forearm
Flexor digitorum superficialis	*Humero-ulnar head:* medial epicondyle of humerus and coronoid process of ulna *Radial head:* superior half of anterior radius	Bodies of middle phalanges of medial four digits	Median nerve	Flexes middle and proximal phalanges of medial four digits, flexes hand at wrist	Ulnar and radial arteries	Anterior forearm
Flexor pollicis brevis	Flexor retinaculum and tubercle of trapezium	Lateral side of base of proximal phalanx of thumb	Median nerve (recurrent branch)	Flexes proximal phalanx of thumb	Superficial palmar branch of radial artery	Hand
Flexor pollicis longus	Anterior surface of radius and interosseous membrane	Palmar base of distal phalanx of thumb	Median nerve (anterior interosseous)	Flexes phalanges of thumb	Anterior interosseous artery	Anterior forearm
Infraspinatus	Infraspinous fossa of scapula and deep fascia	Middle facet of greater tubercle of humerus	Suprascapular nerve	Lateral rotation of arm (with teres minor)	Suprascapular artery	Shoulder

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Latissimus dorsi	Spinous processes of T7–L5 vertebrae, thoracolumbar fascia, iliac crest, last 3 ribs	Intertubercular sulcus of humerus	Thoracodorsal nerve	Extends, adducts, and medially rotates humerus at shoulder	Thoracodorsal artery, dorsal perforating branches of 9th, 10th, and 11th posterior intercostal, subcostal, and first three lumbar arteries	Shoulder
Levator scapulae	Posterior tubercles of transverse processes of C1–C4	Medial border of scapula from superior angle to spine	Ventral rami of C3–C4 and dorsal scapular nerve	Elevates scapula medially, inferiorly rotates glenoid cavity	Dorsal scapular artery, transverse cervical artery, ascending cervical artery	Superficial back
Lumbrical, first and second	Lateral two tendons of flexor digitorum profundus	Lateral sides of extensor expansion of digits 2 and 3	Median nerve (digital branches)	Extend digits at interphalangeal joints, flex metacarpophalangeal joints	Superficial and deep palmar arches	Hand
Lumbrical, third and fourth	Medial three tendons of flexor digitorum profundus	Lateral sides of extensor expansion of digits 4 and 5	Ulnar nerve (deep branch)	Extend digits at interphalangeal joints, flex metacarpophalangeal joints	Superficial and deep palmar arches	Hand
Opponens digiti minimi	Flexor retinaculum and hook of hamate bone	Palmar surface of 5th metacarpal	Ulnar nerve (deep branch)	Draws 5th metacarpal anteriorly and rotates it to face thumb	Deep palmar branch of ulnar artery	Hand
Opponens pollicis	Flexor retinaculum and tubercle of trapezium	Lateral side of 1st metacarpal	Median nerve (recurrent branch)	Draws 1st metacarpal forward and rotates it medially	Superficial palmar branch of radial artery	Hand
Palmar interosseous muscles	Sides of metacarpals 2, 4, and 5	Bases of proximal phalanx and extensor expansion of digits 2, 4, and 5	Ulnar nerve (deep branch)	Adducts digits toward axial line of hand (3rd digit); flexes digits at metacarpophalngeal joint and extends interphalangeal joints	Deep palmar arch	Hand
Palmaris brevis	Palmar aponeurosis and flexor retinaculum	Skin of medial border of palm	Superficial palmar branch of ulnar nerve	Deepens hollow of hand, assists grip	Superficial palmar arch	Hand
Palmaris longus	Medial epicondyle of humerus	Distal half of flexor retinaculum and palmar aponeurosis	Median nerve	Flexes hand at wrist and tenses palmar aponeurosis	Posterior ulnar recurrent artery	Anterior forearm
Pectoralis major	Sternal half of clavicle, sternum to 7th rib, cartilages of true ribs, aponeurosis of external oblique muscle	Lateral lip of intertubercular sulcus of humerus	Medial and lateral pectoral nerves	Flexes and adducts arm, rotates arm medially	Pectoral branch of thoraco-acromial artery, perforating branches of internal thoracic artery	Pectoral region/ axilla
Pectoralis minor	Outer surface of upper margin of ribs 3–5	Coracoid process of scapula	Medial pectoral nerve	Lowers lateral angle of scapula and protracts scapula	Pectoral branch of thoraco-acromial and intercostal lateral thoracic arteries	Pectoral region/ axilla
Pronator quadratus	Distal fourth of anterior ulna	Distal fourth of anterior radius	Median nerve (anterior interosseous)	Pronates forearm	Anterior interosseous artery	Anterior forearm
Pronator teres	Two heads: medial epicondyle of humerus and coronoid process of ulna	Midway along lateral surface of radius	Median nerve	Pronates forearm and assists with elbow flexion	Anterior ulnar recurrent artery	Anterior forearm

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Rhomboid major	Spinous processes of T2–T5 vertebrae	Medial border of scapula below base of spine of scapula	Dorsal scapular nerve	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid cavity	Dorsal scapular OR deep branch of transverse cervical artery, dorsal perforating branches of the upper five or six posterior intercostal arteries artery	Superficial back
Rhomboid minor	Ligamentum nuchae, spines of C7 and T1 vertebrae	Medial border of scapula at spine of scapula	Dorsal scapular nerve	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid cavity	Dorsal scapular artery OR deep branch of transverse cervical artery, dorsal perforating branches of the upper five or six posterior intercostal arteries	Superficial back
Serratus anterior	Lateral surfaces of upper 8–9 ribs	Costal surface of medial border of scapula	Long thoracic nerve	Protracts and rotates scapula and holds it against thoracic wall	Lateral thoracic artery	Shoulder
Subclavius	Upper border of 1st rib and its cartilage	Inferior surface of middle third of clavicle	Nerve to subclavius	Anchors and depresses clavicle	Clavicular branch of thoraco-acromial artery	Shoulder
Subscapularis	Subscapular fossa	Lesser tubercle of humerus	Upper and lower subscapular nerves	Medially rotates arm at shoulder and adducts it, helps hold humeral head in glenoid cavity	Subscapular artery, lateral thoracic artery	Shoulder
Supinator	Lateral epicondyle of humerus, supinator crest of ulna	Lateral, posterior, and anterior surfaces of proximal third of radius	Radial nerve (deep branch)	Supinates forearm	Radial recurrent artery, posterior interosseous arteries	Posterior forearm
Supraspinatus	Supraspinous fossa of scapula and deep fascia	Superior facet of greater tubercle of humerus	Suprascapular nerve	Initiates arm abduction, acts with rotator cuff muscles	Suprascapular artery	Shoulder
Teres major	Posterior surface of inferior angle of scapula	Medial lip of intertubercular sulcus of humerus	Lower subscapular nerve	Adducts and medially rotates arm	Circumflex scapular artery	Shoulder
Teres minor	Upper 2/3 of posterior surface of lateral border of scapula	Inferior facet of greater tubercle of humerus	Axillary nerve	Laterally rotates arm	Circumflex scapular artery	Shoulder
Trapezius	Superior nuchal line, external occipital protuberance, nuchal ligament, spinous processes of C7–T12	Lateral third of clavicle, acromion, and spine of scapula	Accessory nerve (cranial nerve XI)	Elevates, retracts, and rotates scapula; lower fibers depress scapula	Transverse cervical artery, dorsal perforating branches of posterior intercostal arteries	Superficial back
Triceps brachii	*Long head:* infraglenoid tubercle of scapula *Lateral head:* upper half of posterior humerus *Medial head:* distal 2/3 of medial and posterior humerus	Posterior surface of olecranon process of ulna	Radial nerve	Extends forearm at elbow; long head stabilizes head of abducted humerus and extends and adducts arm at shoulder	Branch of profunda brachii artery	Arm



Section

7 LOWER LIMB

Topographic Anatomy

Plate 468

468 Lower Limb: Surface Anatomy

Cutaneous Anatomy

Plates 469–472

469 Dermatomes of Lower Limb

470 Superficial Nerves and Veins of Lower Limb: Anterior View

471 Superficial Nerves and Veins of Lower Limb: Posterior View

472 Lymph Vessels and Nodes of Lower Limb

Hip and Thigh

Plates 473–492

473 Hip (Coxal) Bone

474 Hip Joint

475 Hip Joint: Anteroposterior Radiograph

476 Femur

477 Bony Attachments of Muscles of Hip and Thigh: Anterior View

478 Bony Attachments of Muscles of Hip and Thigh: Posterior View

479 Muscles of Thigh: Anterior Views

480 Muscles of Thigh: Anterior Views (continued)

481 Muscles of Hip and Thigh: Lateral View

482 Muscles of Hip and Thigh: Posterior Views

483 Psoas and Iliacus Muscles

484 Lumbosacral and Coccygeal Plexuses
485 Lumbar Plexus
486 Sacral and Coccygeal Plexuses
487 Arteries and Nerves of Thigh: Anterior Views
488 Arteries and Nerves of Thigh: Anterior Views (continued)
489 Arteries and Nerves of Thigh: Posterior View
490 Nerves of Hip and Buttock
491 Arteries of Femoral Head and Neck
492 Thigh: Serial Cross Sections

Knee

Plates 493–499

493 Knee: Medial and Lateral Views
494 Knee: Anterior Views
495 Knee: Interior
496 Knee: Cruciate and Collateral Ligaments
497 Knee: Anteroposterior Radiograph and Posterior View
498 Knee: Posterior and Sagittal Views
499 Arteries of Thigh and Knee: Schema

Leg

Plates 500–510

500 Tibia and Fibula
501 Tibia and Fibula (continued)
502 Attachments of Muscles of Leg
503 Muscles of Leg (Superficial Dissection): Posterior View
504 Muscles of Leg (Intermediate Dissection): Posterior View
505 Muscles of Leg (Deep Dissection): Posterior View
506 Muscles of Leg: Lateral View
507 Muscles of Leg (Superficial Dissection): Anterior View
508 Muscles of Leg (Deep Dissection): Anterior View
509 Arteries of Knee, Leg, and Foot
510 Leg: Cross Sections and Fascial Compartments

Ankle and Foot

Plates 511–524

511 Bones of Foot
512 Bones of Foot (continued)
513 Calcaneus
514 Ligaments and Tendons of Ankle
515 Ligaments and Tendons of Foot: Plantar View
516 Tendon Sheaths of Ankle
517 Muscles of Dorsum of Foot: Superficial Dissection
518 Dorsum of Foot: Deep Dissection
519 Sole of Foot: Superficial Dissection
520 Muscles of Sole of Foot: First Layer
521 Muscles of Sole of Foot: Second Layer
522 Muscles of Sole of Foot: Third Layer
523 Interosseous Muscles and Deep Arteries of Foot
524 Interosseous Muscles of Foot

Neurovasculature

Plates 525–529

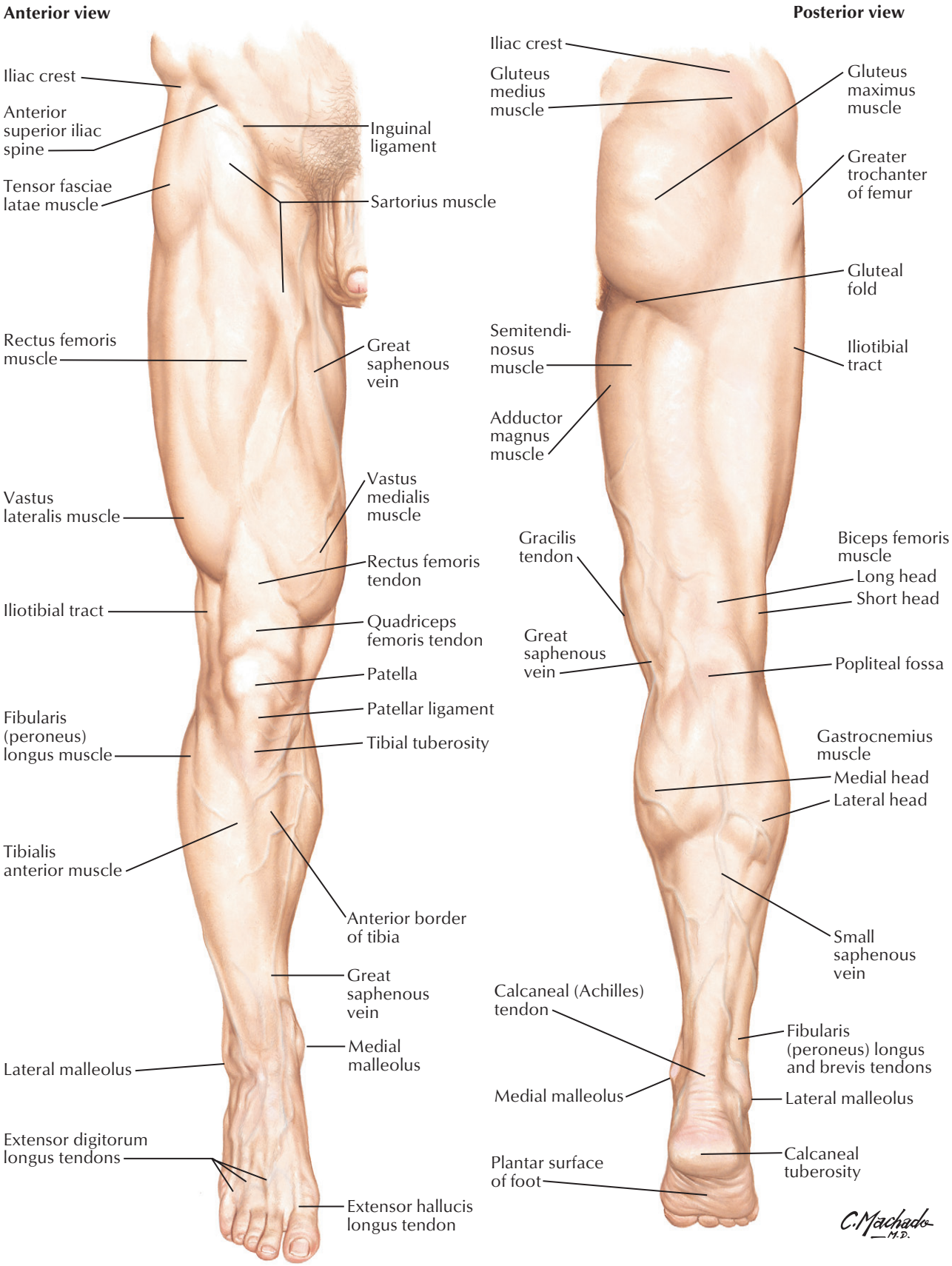
525 Femoral Nerve and Lateral Cutaneous Nerve of Thigh
526 Obturator Nerve
527 Sciatic Nerve and Posterior Cutaneous Nerve of Thigh
528 Tibial Nerve
529 Common Fibular (Peroneal) Nerve

Regional Scans

Plates 530–531

530 Hip Radiograph, Arthrogram, and MRI
531 Ankle: Radiographs

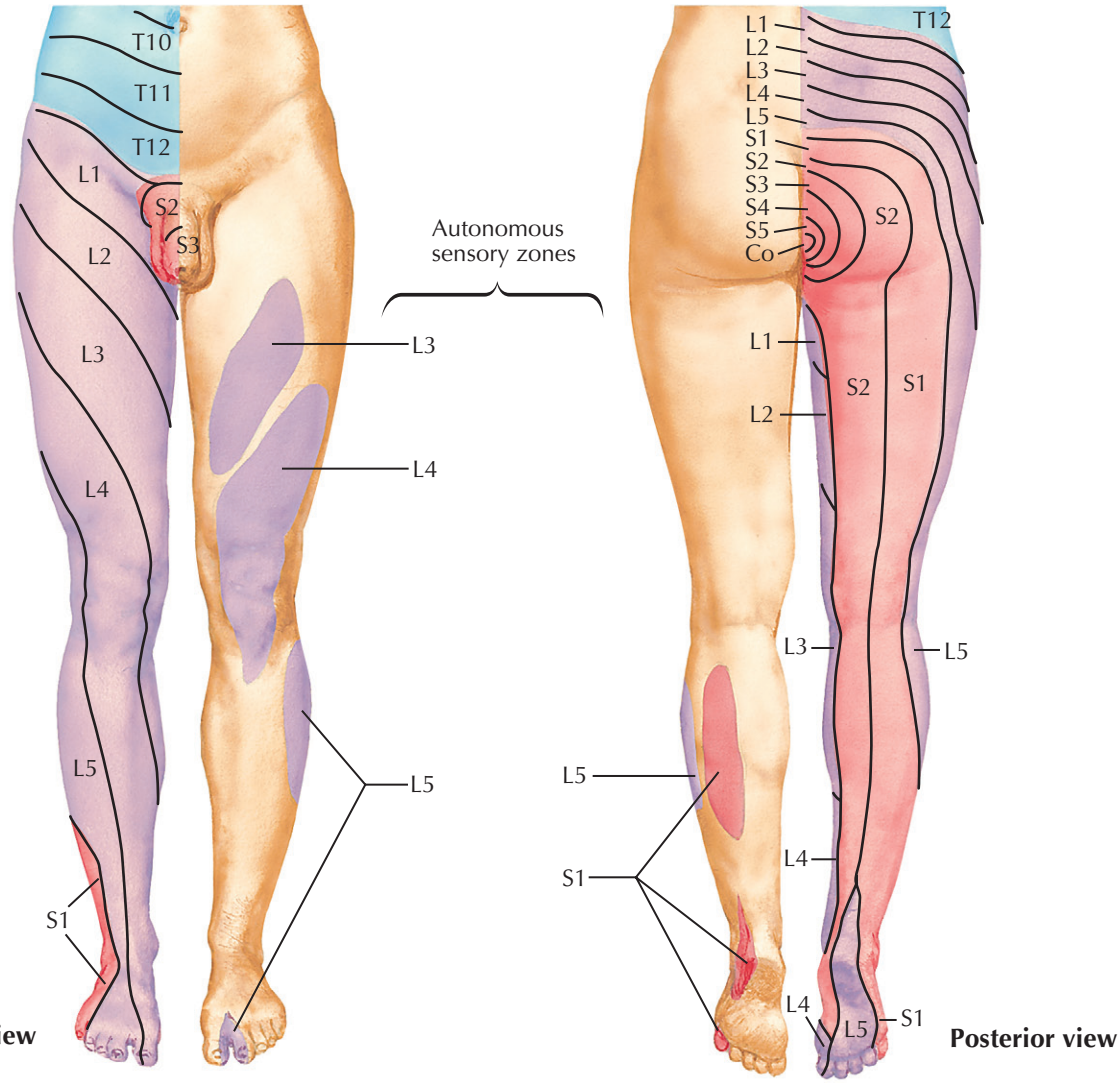
Muscle Tables


Anterior view
Iliac crest
Anterior superior iliac spine
Tensor fasciae latae muscle
Inguinal ligament
Sartorius muscle
Rectus femoris muscle
Great saphenous vein
Vastus lateralis muscle
Vastus medialis muscle
Rectus femoris tendon
Iliotibial tract
Quadriceps femoris tendon
Patella
Patellar ligament
Fibularis (peroneus) longus muscle
Tibial tuberosity
Tibialis anterior muscle
Anterior border of tibia
Great saphenous vein
Medial malleolus
Lateral malleolus
Extensor digitorum longus tendons
Extensor hallucis longus tendon
Posterior view
Iliac crest
Gluteus medius muscle
Gluteus maximus muscle
Greater trochanter of femur
Gluteal fold
Semitendinosus muscle
Iliotibial tract
Adductor magnus muscle
Gracilis tendon
Biceps femoris muscle
Long head
Short head
Great saphenous vein
Popliteal fossa
Gastrocnemius muscle
Medial head
Lateral head
Small saphenous vein
Calcaneal (Achilles) tendon
Fibularis (peroneus) longus and brevis tendons
Medial malleolus
Lateral malleolus
Calcaneal tuberosity
Plantar surface of foot
C. Machado M.D.

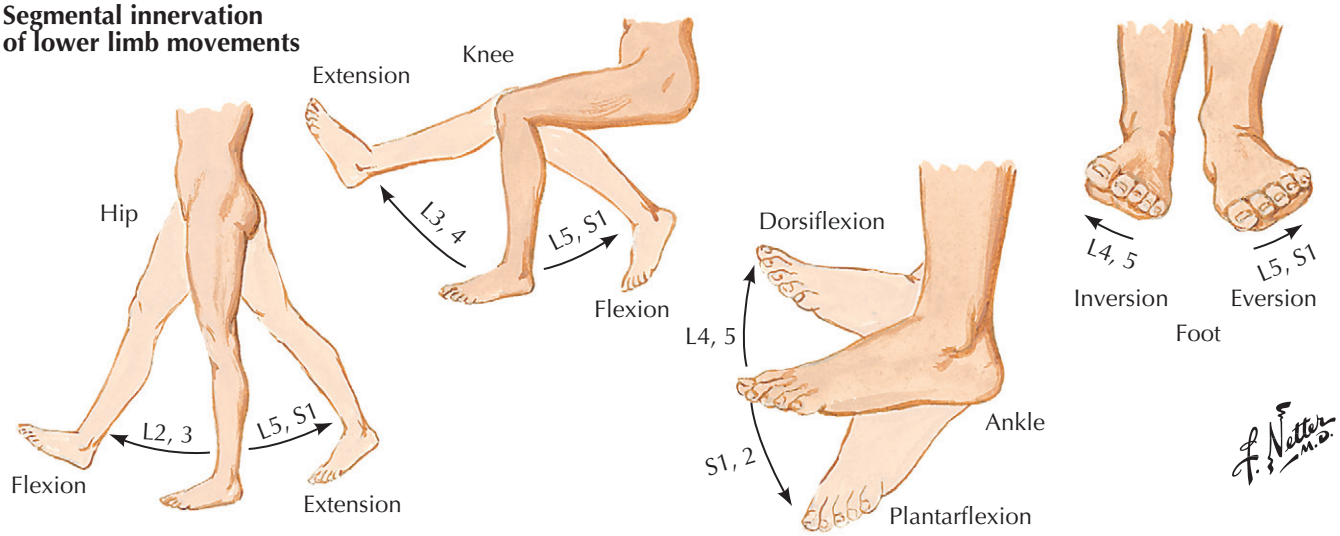
Dermatomes of Lower Limb

See also Plate 162

Schematic demarcation of dermatomes (according to Keegan and Garrett) shown as distinct segments. There is actually considerable overlap between any two adjacent dermatomes.

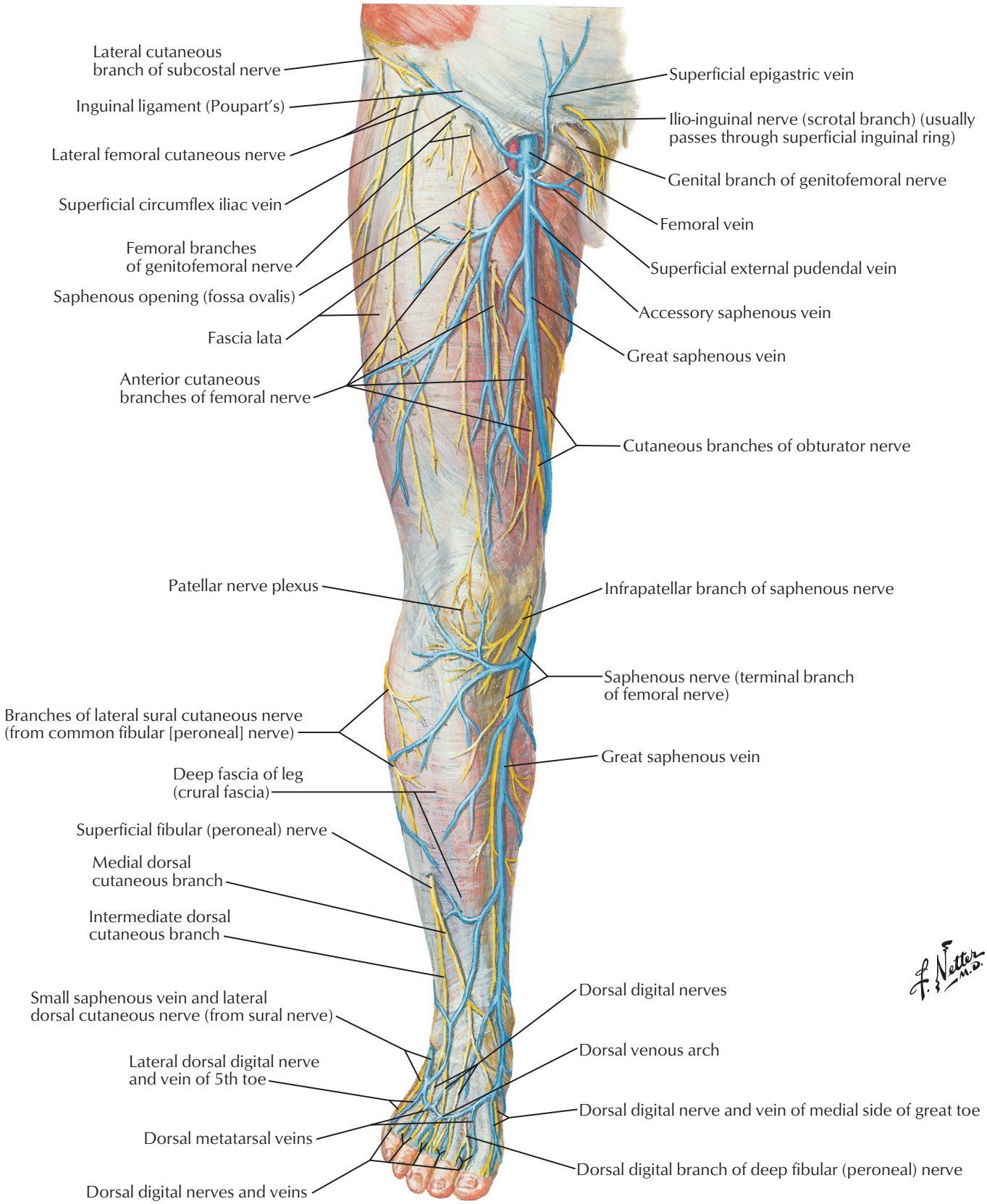


Segmental innervation of lower limb movements



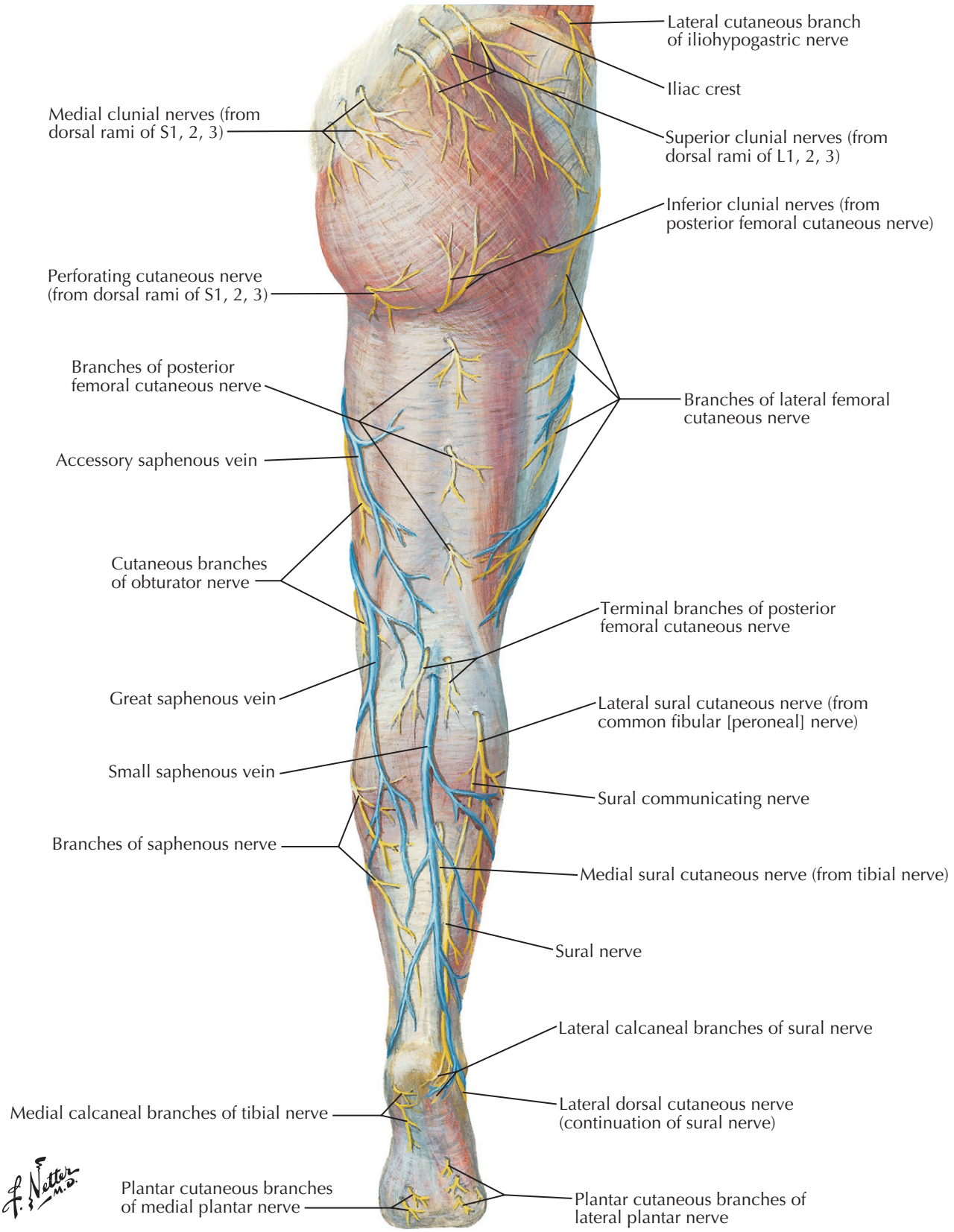
Superficial Nerves and Veins of Lower Limb: Anterior View

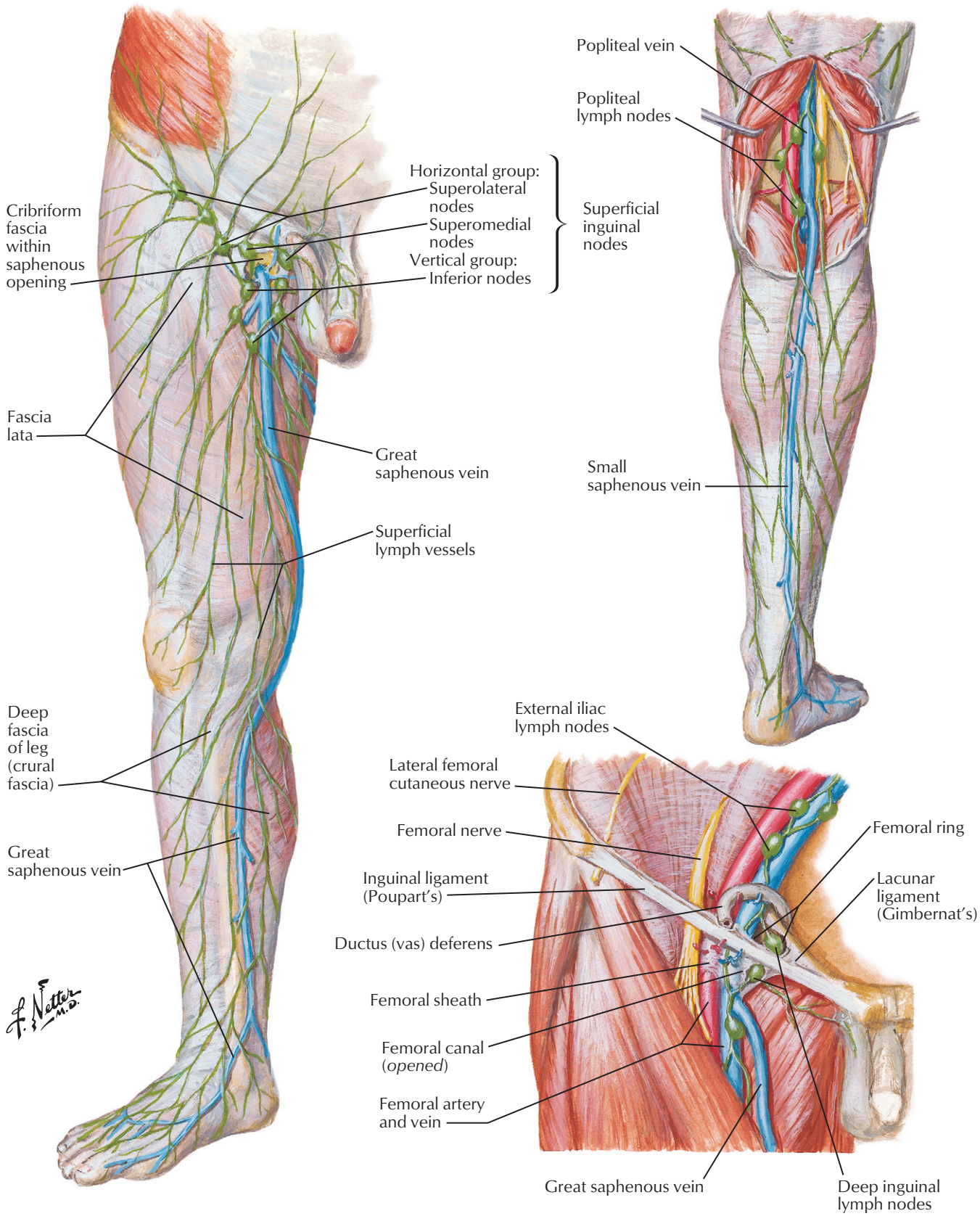
See also Plates 525, 526, 529

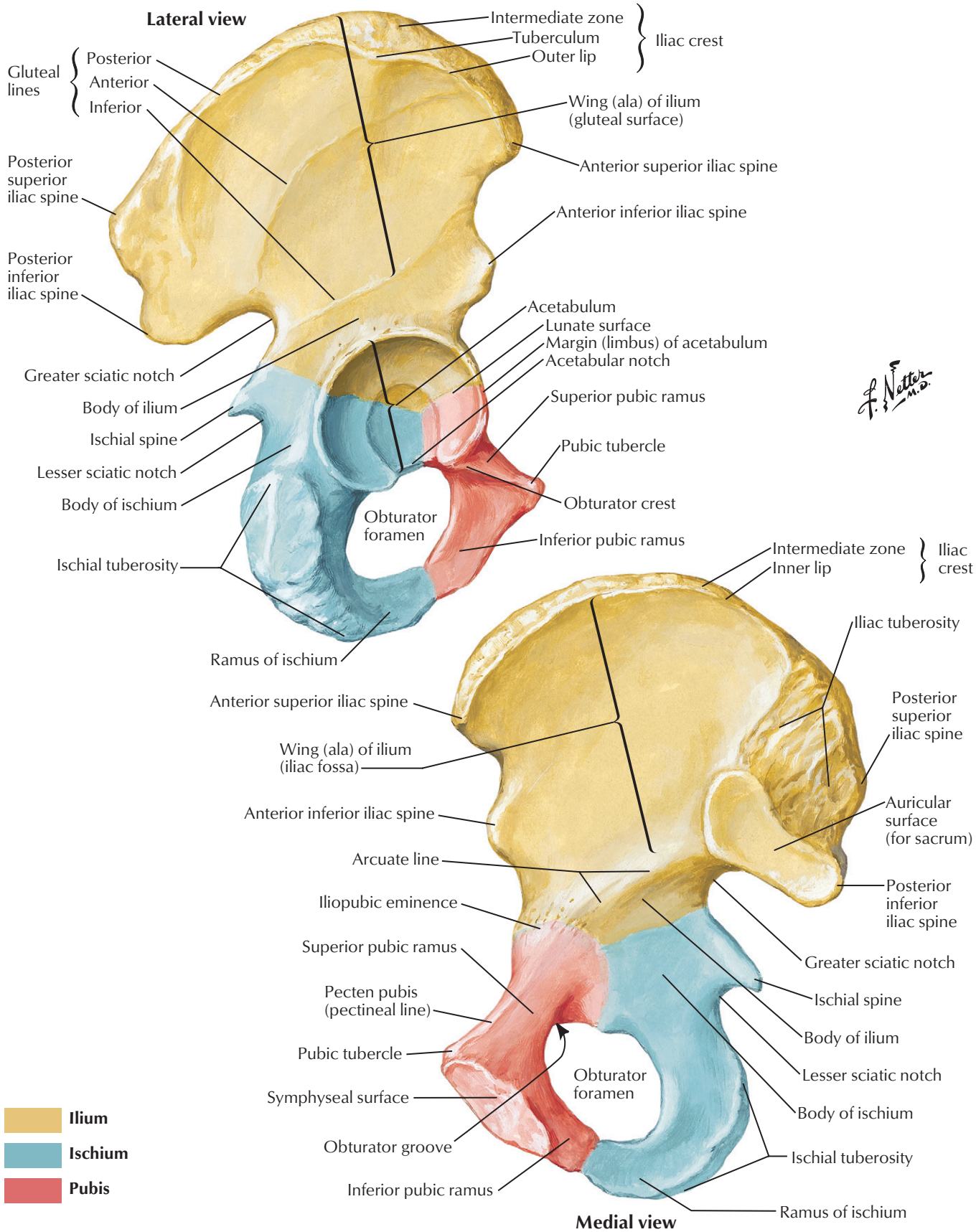


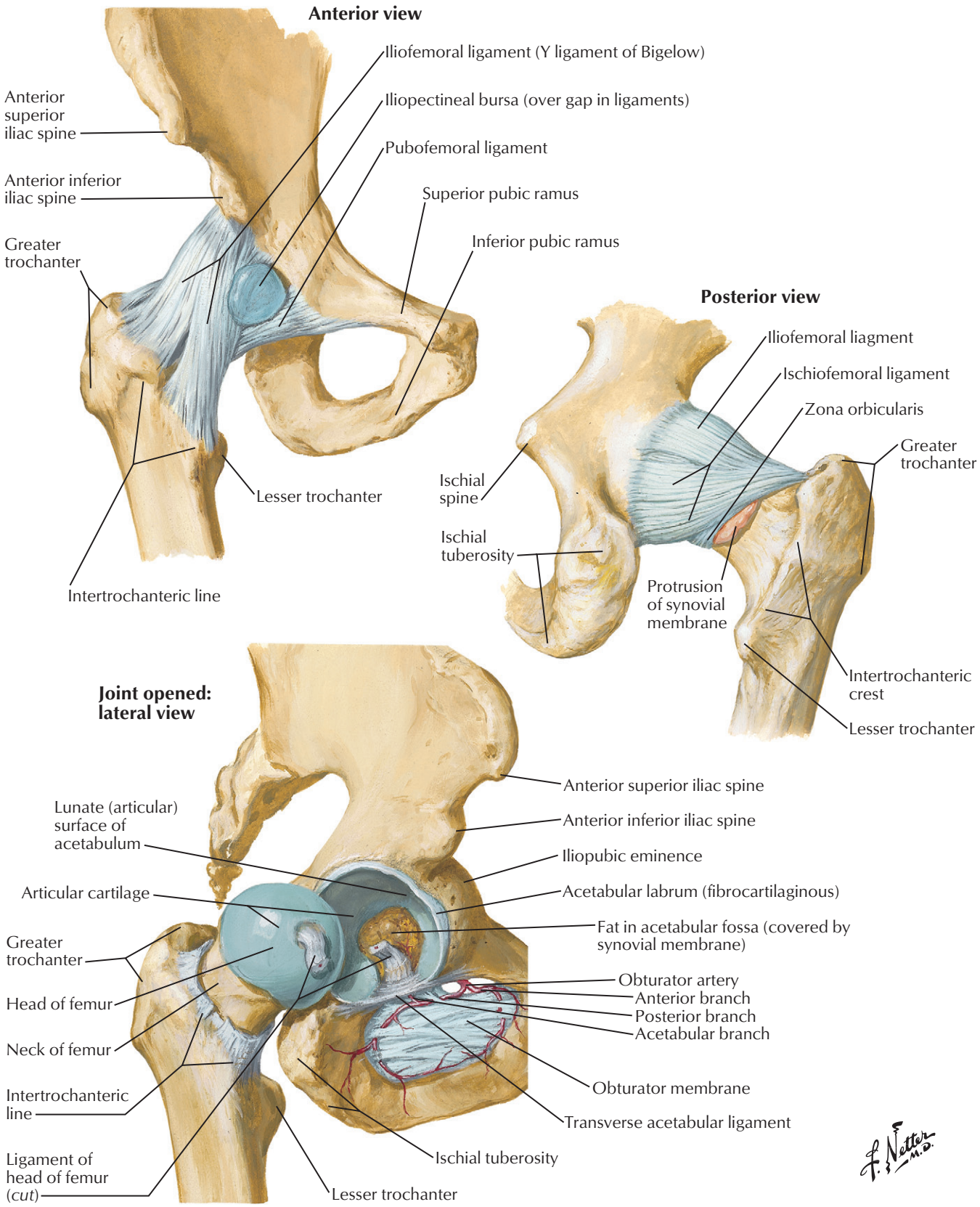
Superficial Nerves and Veins of Lower Limb: Posterior View

See also Plates 527, 528



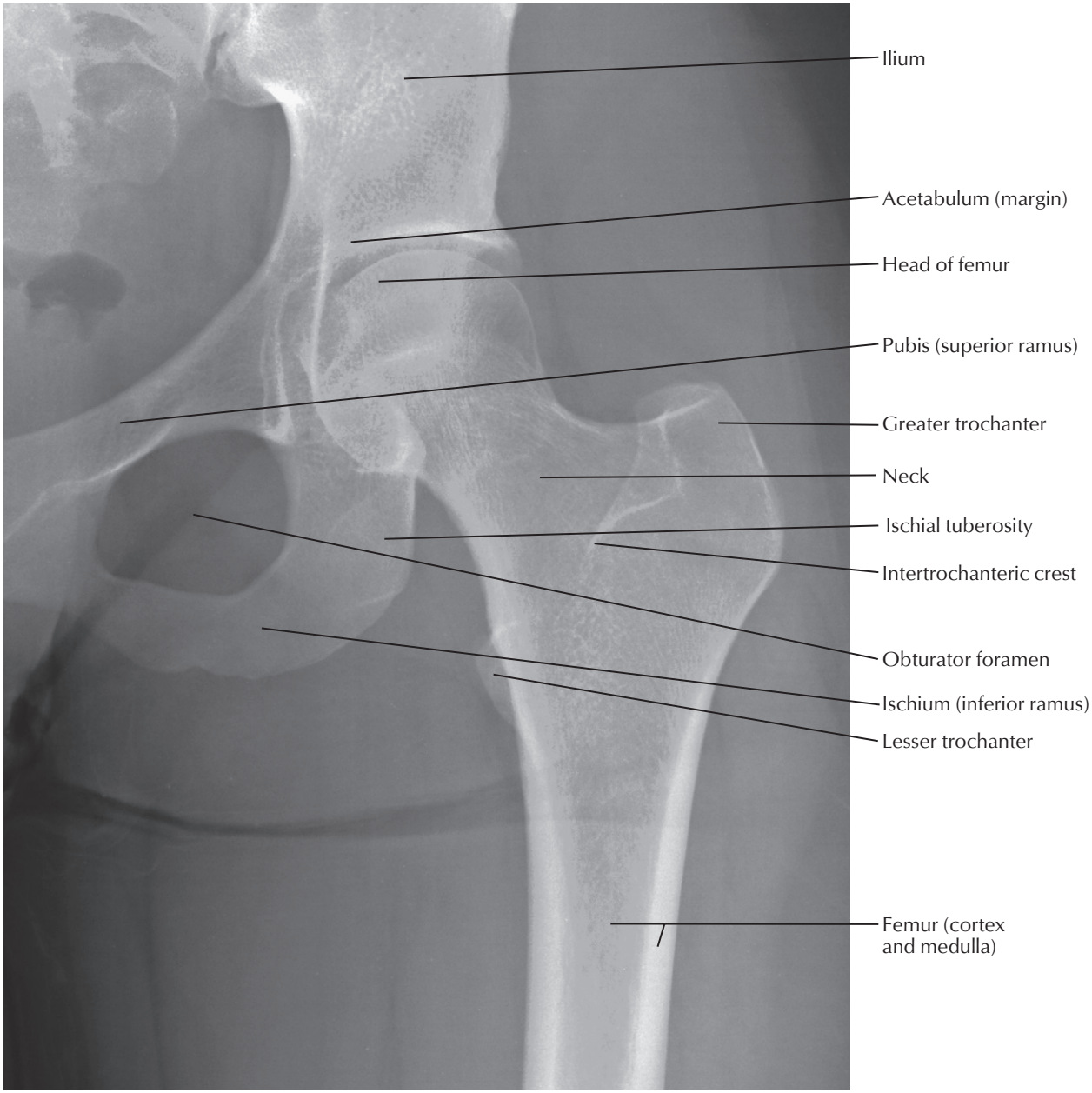

Cribriform fascia within saphenous opening
Horizontal group:
Superolateral nodes
Superomedial nodes
Vertical group:
Inferior nodes
Superficial inguinal nodes
Fascia lata
Great saphenous vein
Superficial lymph vessels
Deep fascia of leg (crural fascia)
Great saphenous vein
Popliteal vein
Popliteal lymph nodes
Small saphenous vein
External iliac lymph nodes
Lateral femoral cutaneous nerve
Femoral nerve
Inguinal ligament (Poupart's)
Ductus (vas) deferens
Femoral sheath
Femoral canal (opened)
Femoral artery and vein
Femoral ring
Lacunar ligament (Gimbernat's)
Great saphenous vein
Deep inguinal lymph nodes

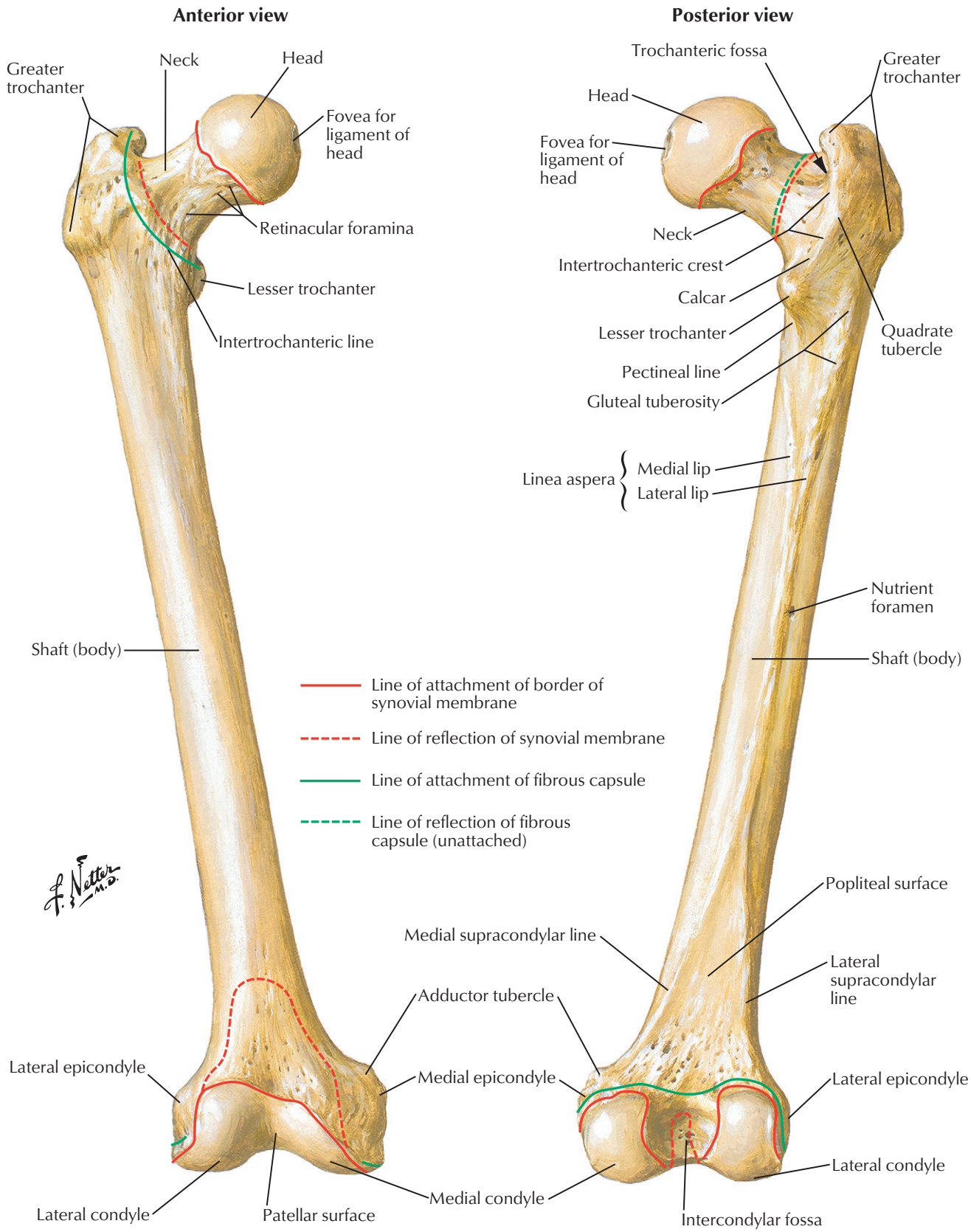

Lateral view
Intermediate zone
Tuberculum
Outer lip
Iliac crest
Gluteal lines
Posterior
Anterior
Inferior
Wing (ala) of ilium (gluteal surface)
Anterior superior iliac spine
Posterior superior iliac spine
Anterior inferior iliac spine
Posterior inferior iliac spine
Acetabulum
Lunate surface
Margin (limbus) of acetabulum
Acetabular notch
Greater sciatic notch
Superior pubic ramus
Body of ilium
Ischial spine
Pubic tubercle
Lesser sciatic notch
Obturator crest
Body of ischium
Obturator foramen
Inferior pubic ramus
Ischial tuberosity
Ramus of ischium
Intermediate zone
Inner lip
Iliac crest
Iliac tuberosity
Anterior superior iliac spine
Posterior superior iliac spine
Wing (ala) of ilium (iliac fossa)
Anterior inferior iliac spine
Auricular surface (for sacrum)
Arcuate line
Posterior inferior iliac spine
Iliopubic eminence
Greater sciatic notch
Superior pubic ramus
Ischial spine
Pecten pubis (pectineal line)
Body of ilium
Pubic tubercle
Lesser sciatic notch
Obturator foramen
Symphyseal surface
Body of ischium
Obturator groove
Ischial tuberosity
Inferior pubic ramus
Ramus of ischium
Medial view
Ilium
Ischium
Pubis


Anterior view
Iliofemoral ligament (Y ligament of Bigelow)
Iliopectineal bursa (over gap in ligaments)
Pubofemoral ligament
Superior pubic ramus
Inferior pubic ramus
Anterior superior iliac spine
Anterior inferior iliac spine
Greater trochanter
Lesser trochanter
Intertrochanteric line
Posterior view
Iliofemoral liagment
Ischiofemoral ligament
Zona orbicularis
Greater trochanter
Ischial spine
Ischial tuberosity
Protrusion of synovial membrane
Intertrochanteric crest
Lesser trochanter
Joint opened: lateral view
Anterior superior iliac spine
Anterior inferior iliac spine
Iliopubic eminence
Acetabular labrum (fibrocartilaginous)
Fat in acetabular fossa (covered by synovial membrane)
Obturator artery
Anterior branch
Posterior branch
Acetabular branch
Obturator membrane
Transverse acetabular ligament
Ischial tuberosity
Lesser trochanter
Lunate (articular) surface of acetabulum
Articular cartilage
Greater trochanter
Head of femur
Neck of femur
Intertrochanteric line
Ligament of head of femur (cut)

Hip Joint: Anteroposterior Radiograph

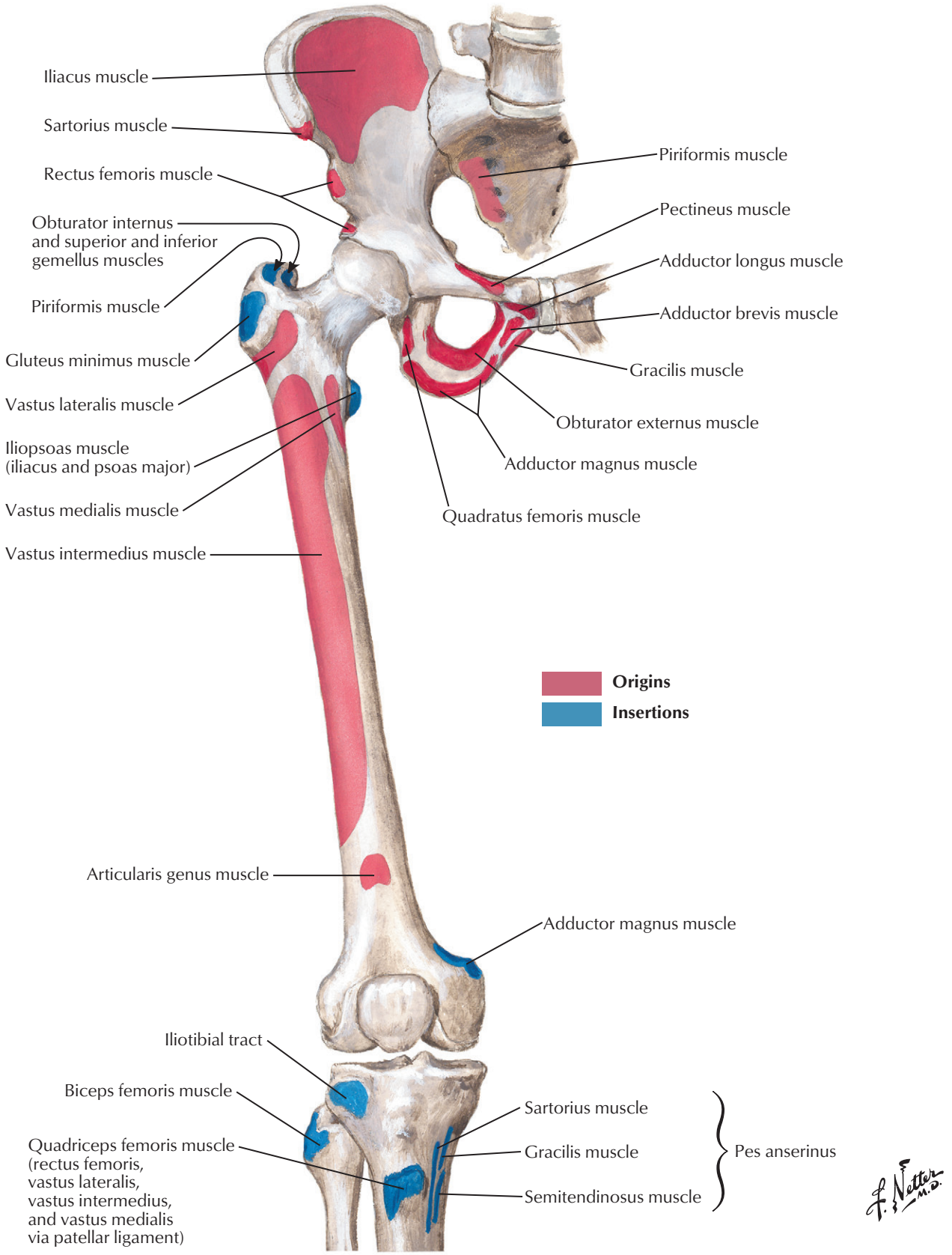
See also Plates 331, 474, 478




Anterior view
Greater trochanter
Neck
Head
Fovea for ligament of head
Retinacular foramina
Lesser trochanter
Intertrochanteric line
Shaft (body)
Lateral epicondyle
Lateral condyle
Patellar surface
Medial condyle
Adductor tubercle
Medial epicondyle
Posterior view
Trochanteric fossa
Greater trochanter
Head
Fovea for ligament of head
Neck
Intertrochanteric crest
Calcar
Lesser trochanter
Pectineal line
Gluteal tuberosity
Quadrate tubercle
Linea aspera
Medial lip
Lateral lip
Nutrient foramen
Shaft (body)
Popliteal surface
Medial supracondylar line
Lateral supracondylar line
Lateral epicondyle
Lateral condyle
Intercondylar fossa
Line of attachment of border of synovial membrane
Line of reflection of synovial membrane
Line of attachment of fibrous capsule
Line of reflection of fibrous capsule (unattached)

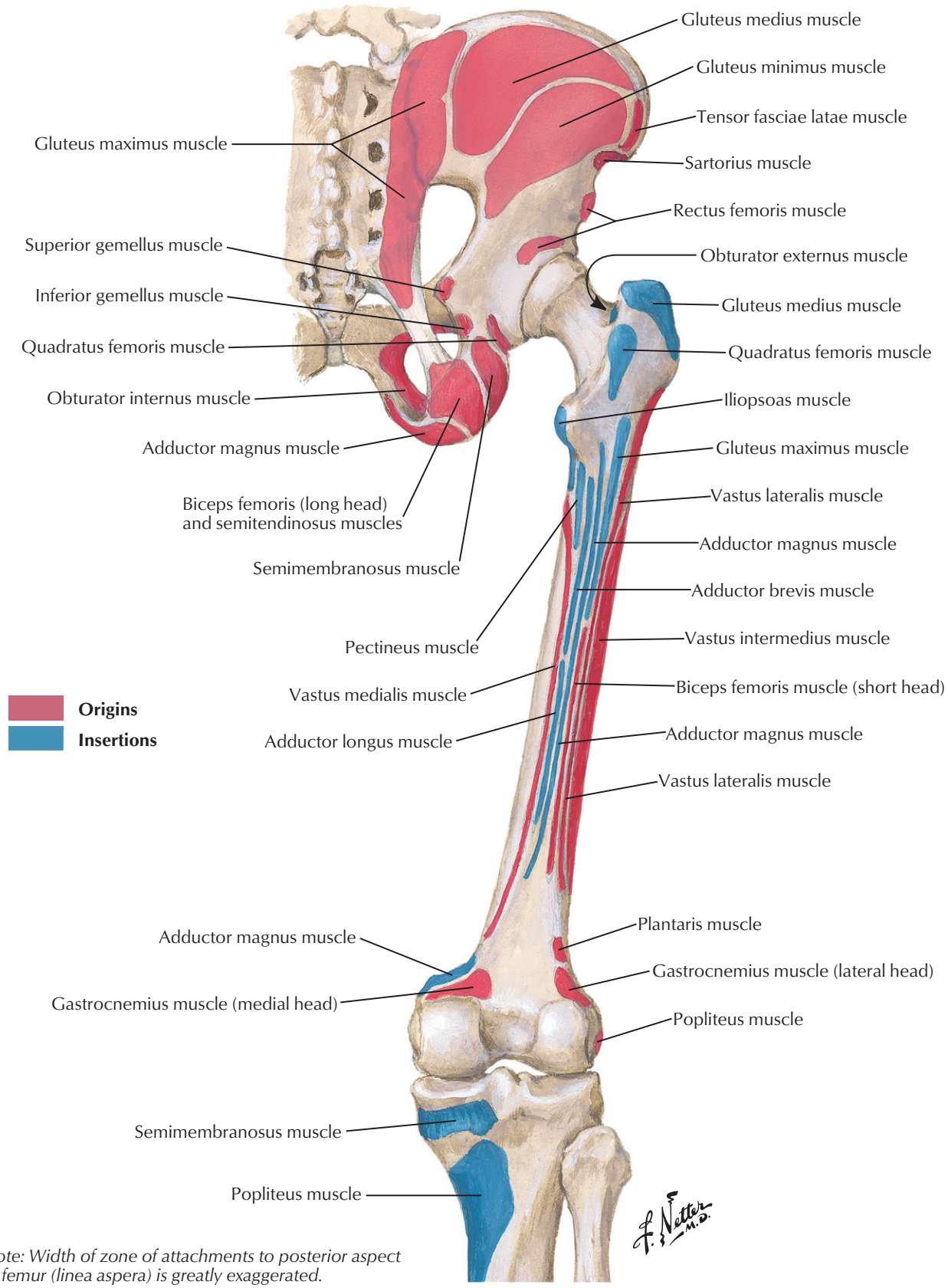
Bony Attachments of Muscles of Hip and Thigh: Anterior View

See also Plate 530



Bony Attachments of Muscles of Hip and Thigh: Posterior View

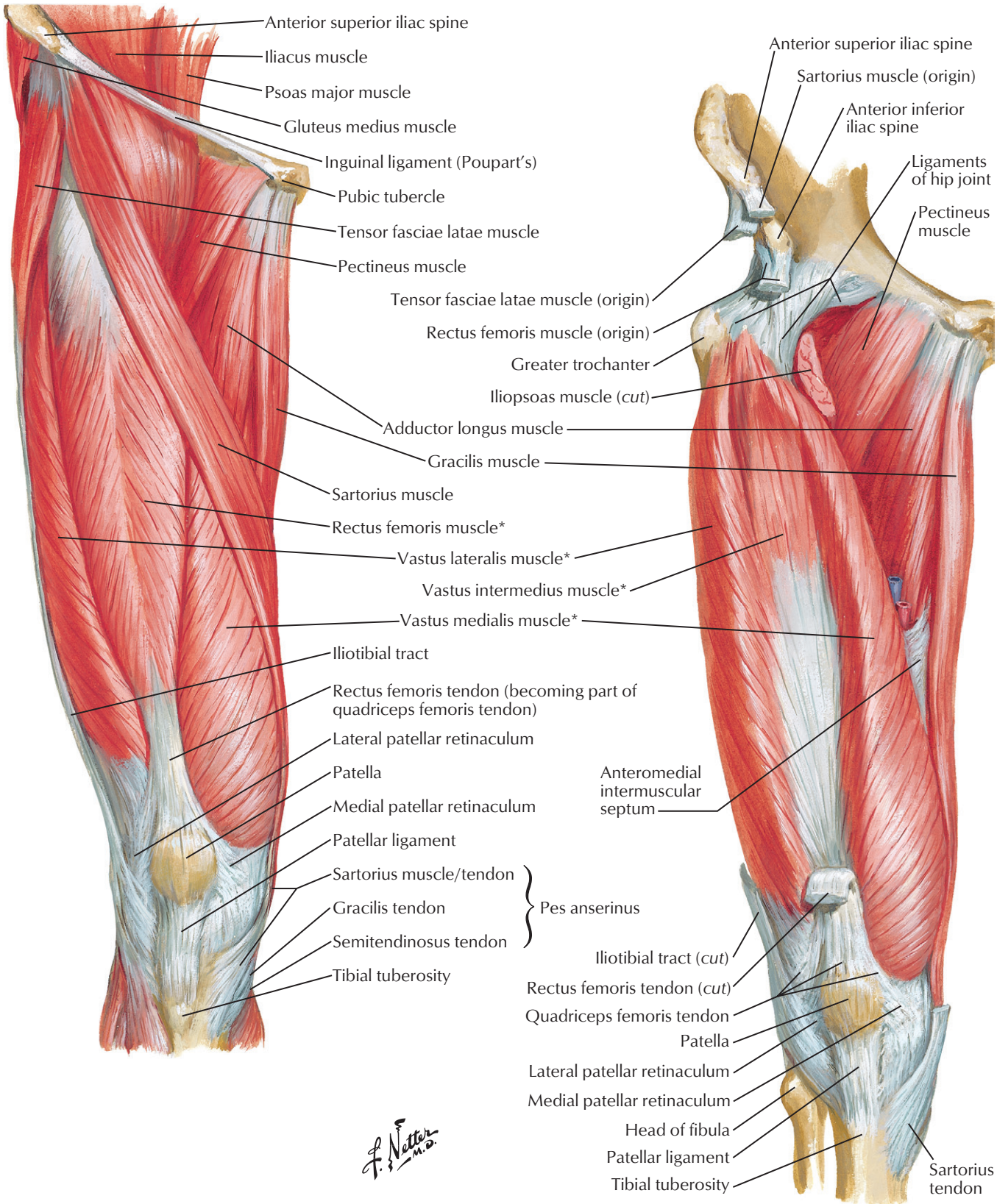
See also Plate 475



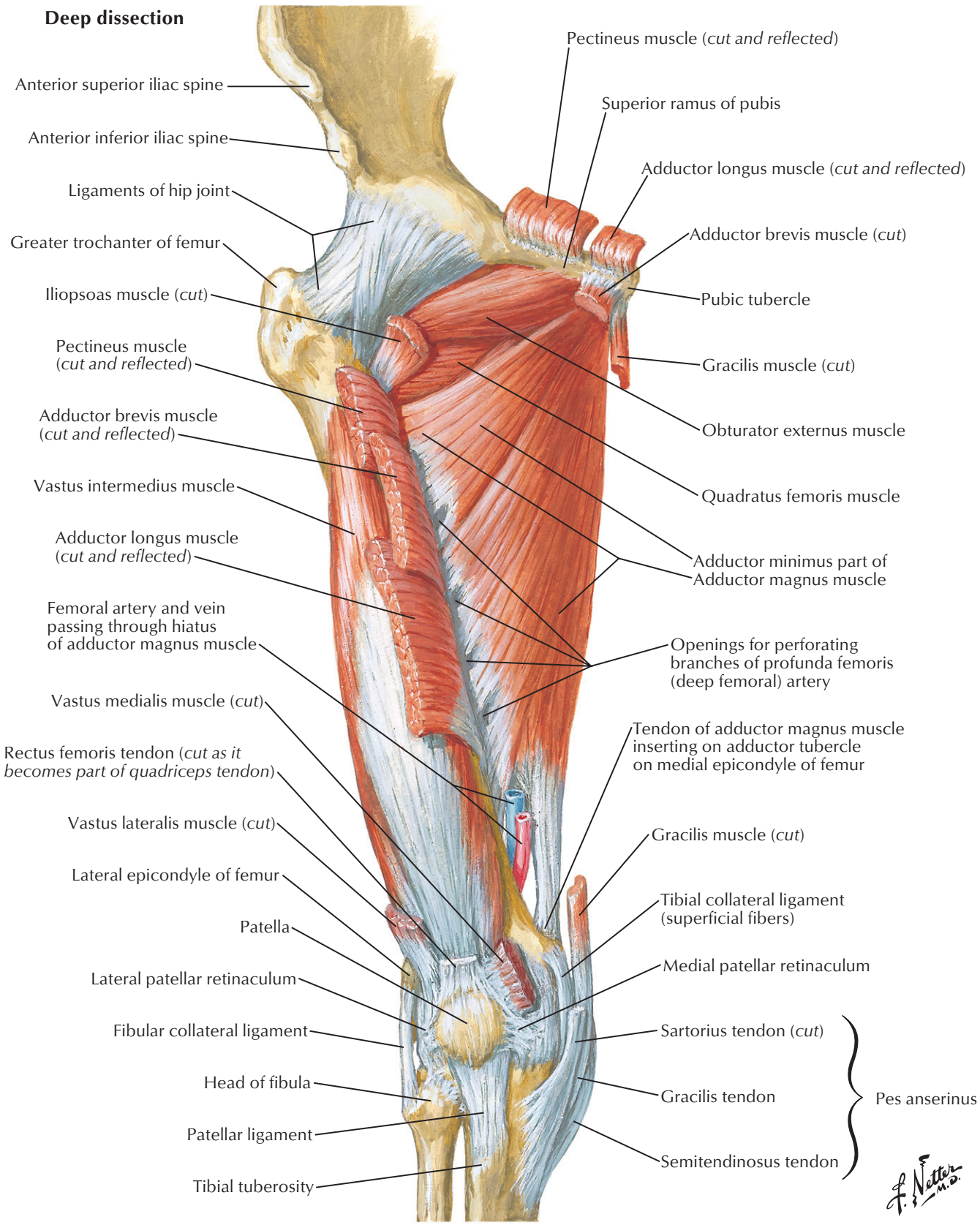
Note: Width of zone of attachments to posterior aspect of femur (linea aspera) is greatly exaggerated.

Muscles of Thigh: Anterior Views

See also Plate 258

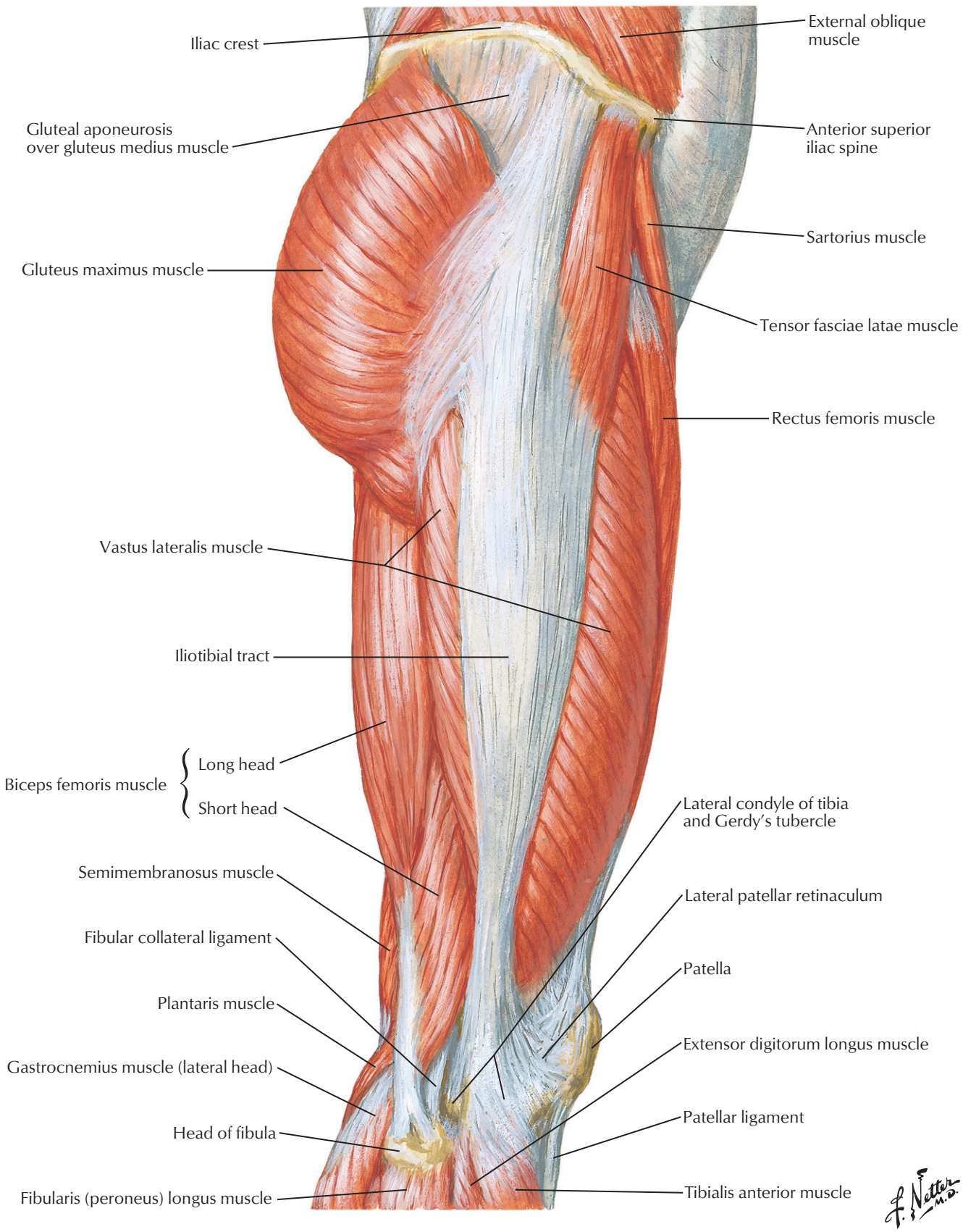


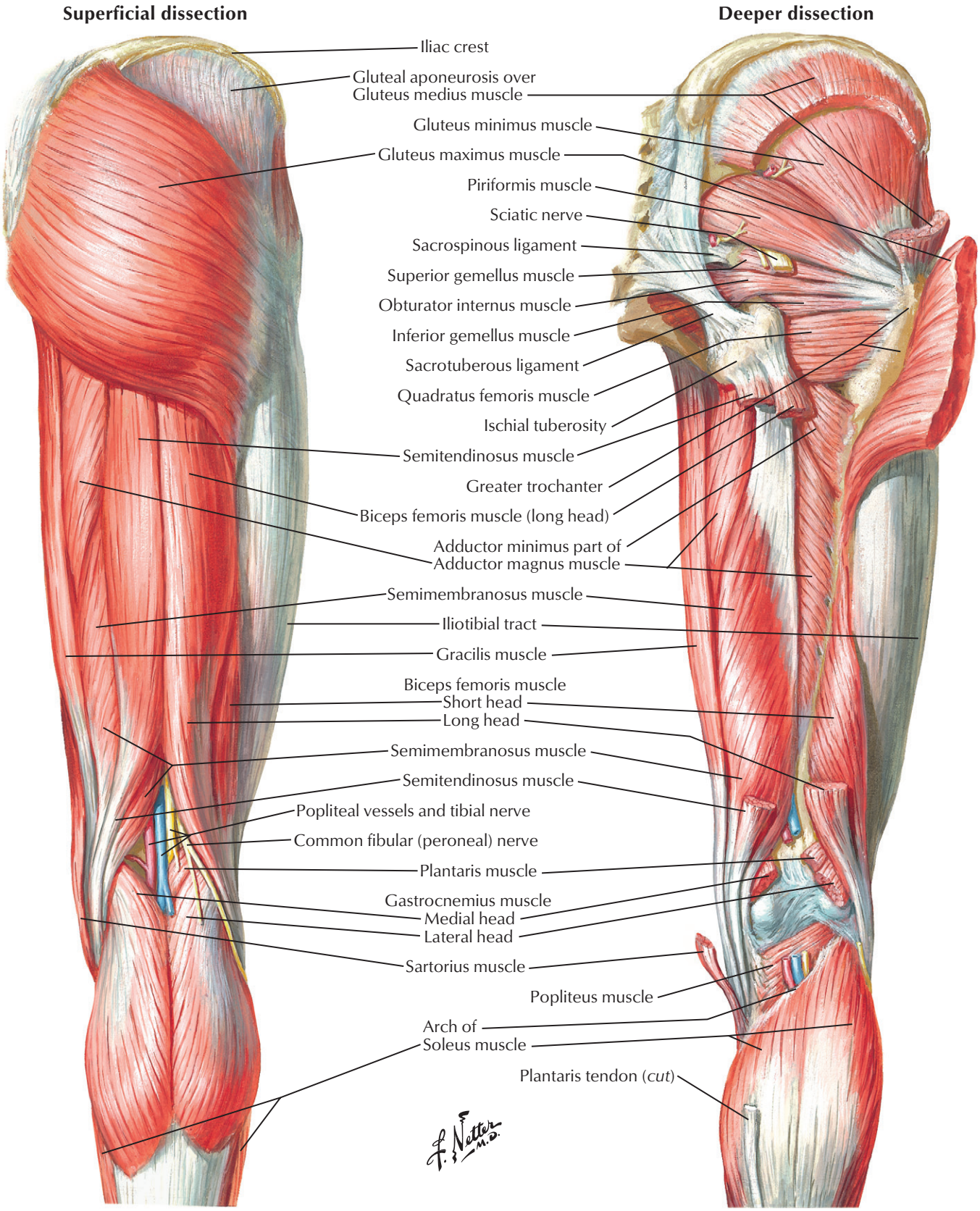
*Muscles of quadriceps femoris


Deep dissection
Anterior superior iliac spine
Anterior inferior iliac spine
Ligaments of hip joint
Greater trochanter of femur
Iliopsoas muscle (cut)
Pectineus muscle (cut and reflected)
Adductor brevis muscle (cut and reflected)
Vastus intermedius muscle
Adductor longus muscle (cut and reflected)
Femoral artery and vein passing through hiatus of adductor magnus muscle
Vastus medialis muscle (cut)
Rectus femoris tendon (cut as it becomes part of quadriceps tendon)
Vastus lateralis muscle (cut)
Lateral epicondyle of femur
Patella
Lateral patellar retinaculum
Fibular collateral ligament
Head of fibula
Patellar ligament
Tibial tuberosity
Pectineus muscle (cut and reflected)
Superior ramus of pubis
Adductor longus muscle (cut and reflected)
Adductor brevis muscle (cut)
Pubic tubercle
Gracilis muscle (cut)
Obturator externus muscle
Quadratus femoris muscle
Adductor minimus part of Adductor magnus muscle
Openings for perforating branches of profunda femoris (deep femoral) artery
Tendon of adductor magnus muscle inserting on adductor tubercle on medial epicondyle of femur
Gracilis muscle (cut)
Tibial collateral ligament (superficial fibers)
Medial patellar retinaculum
Sartorius tendon (cut)
Gracilis tendon
Semitendinosus tendon
Pes anserinus

Muscles of Hip and Thigh: Lateral View

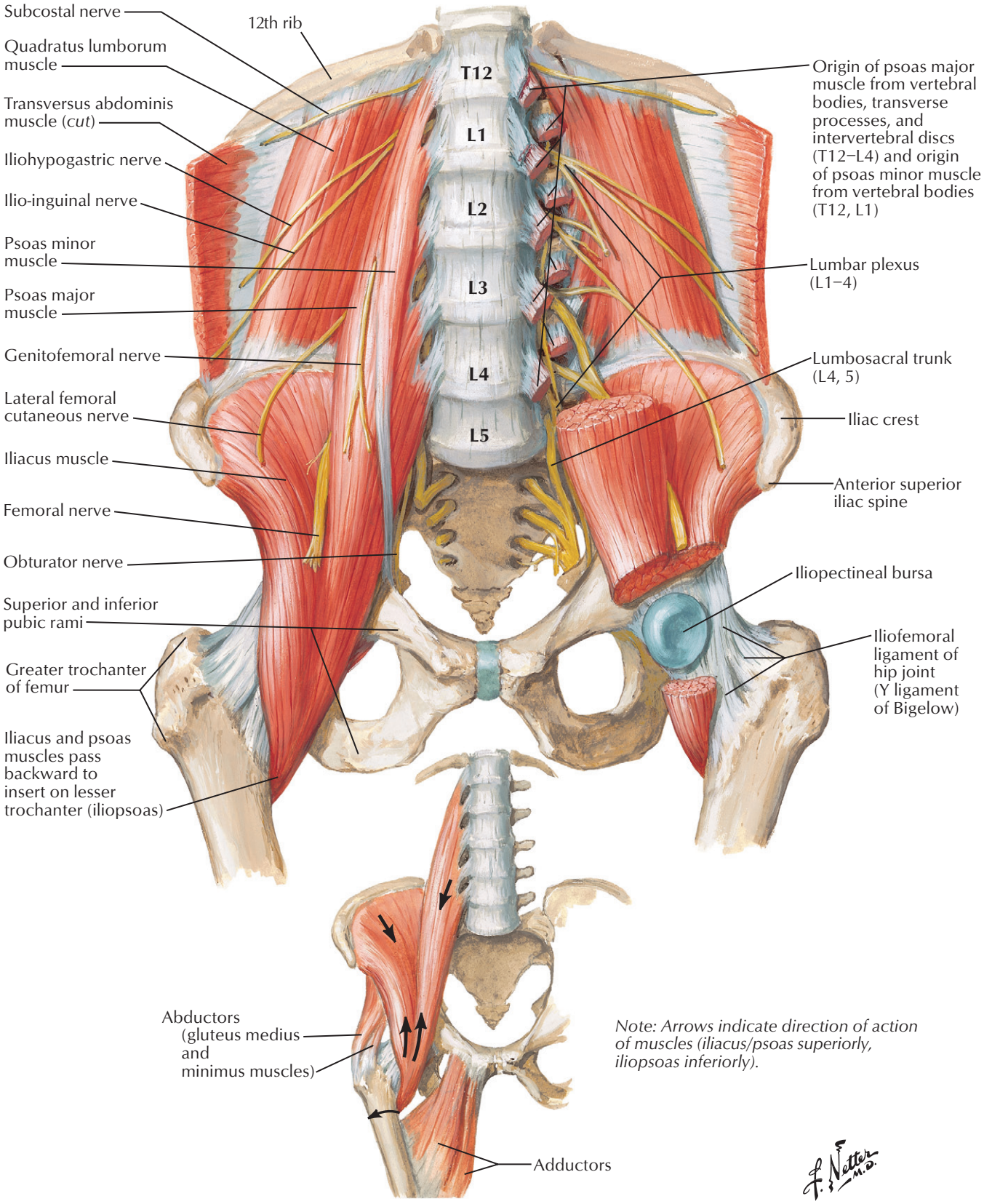
See also Plate 468

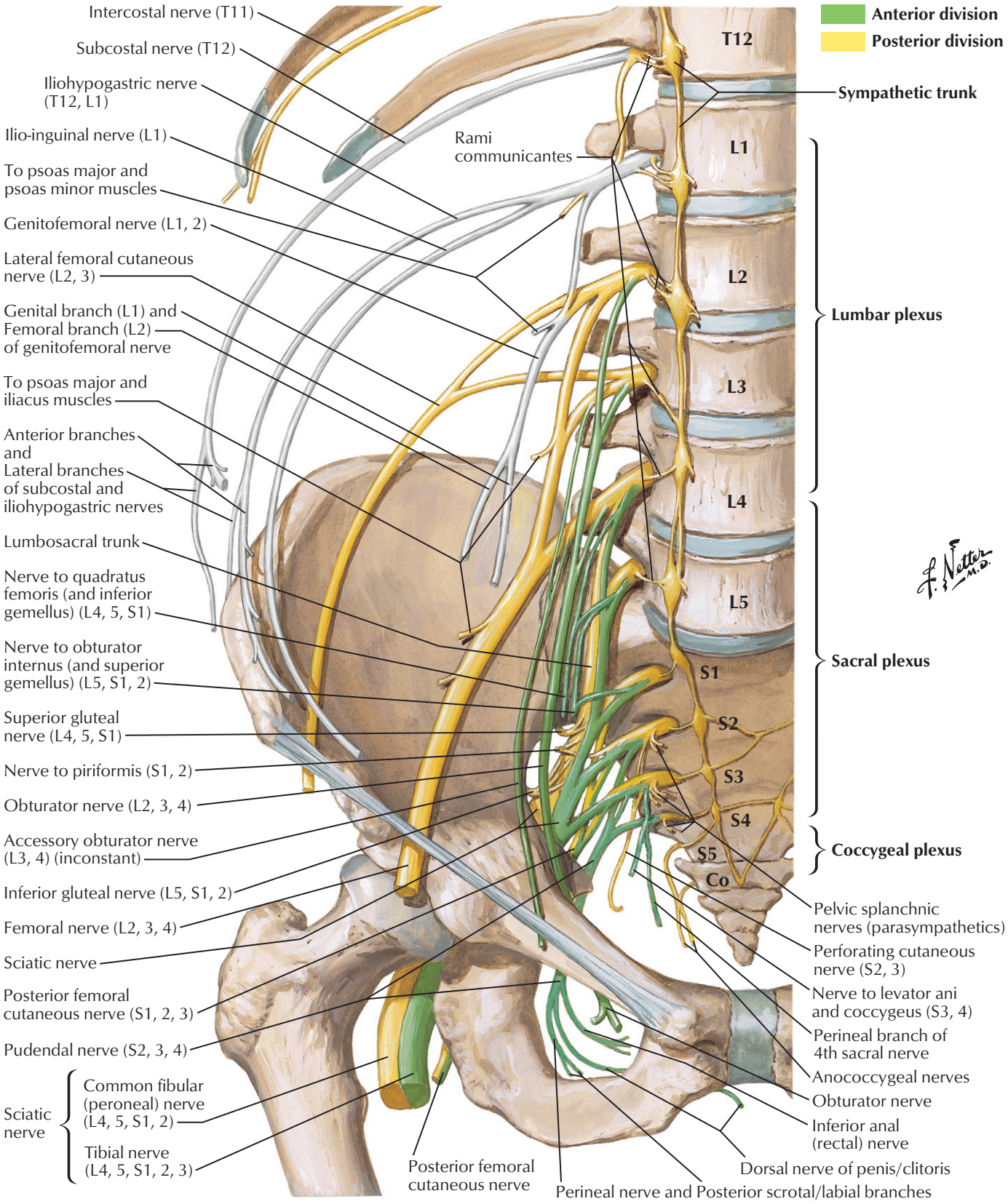



Superficial dissection
Deeper dissection
Iliac crest
Gluteal aponeurosis over Gluteus medius muscle
Gluteus minimus muscle
Gluteus maximus muscle
Piriformis muscle
Sciatic nerve
Sacrospinous ligament
Superior gemellus muscle
Obturator internus muscle
Inferior gemellus muscle
Sacrotuberous ligament
Quadratus femoris muscle
Ischial tuberosity
Semitendinosus muscle
Greater trochanter
Biceps femoris muscle (long head)
Adductor minimus part of Adductor magnus muscle
Semimembranosus muscle
Iliotibial tract
Gracilis muscle
Biceps femoris muscle
Short head
Long head
Semimembranosus muscle
Semitendinosus muscle
Popliteal vessels and tibial nerve
Common fibular (peroneal) nerve
Plantaris muscle
Gastrocnemius muscle
Medial head
Lateral head
Sartorius muscle
Popliteus muscle
Arch of Soleus muscle
Plantaris tendon (cut)
F. Netter M.D.

Psoas and Iliacus Muscles

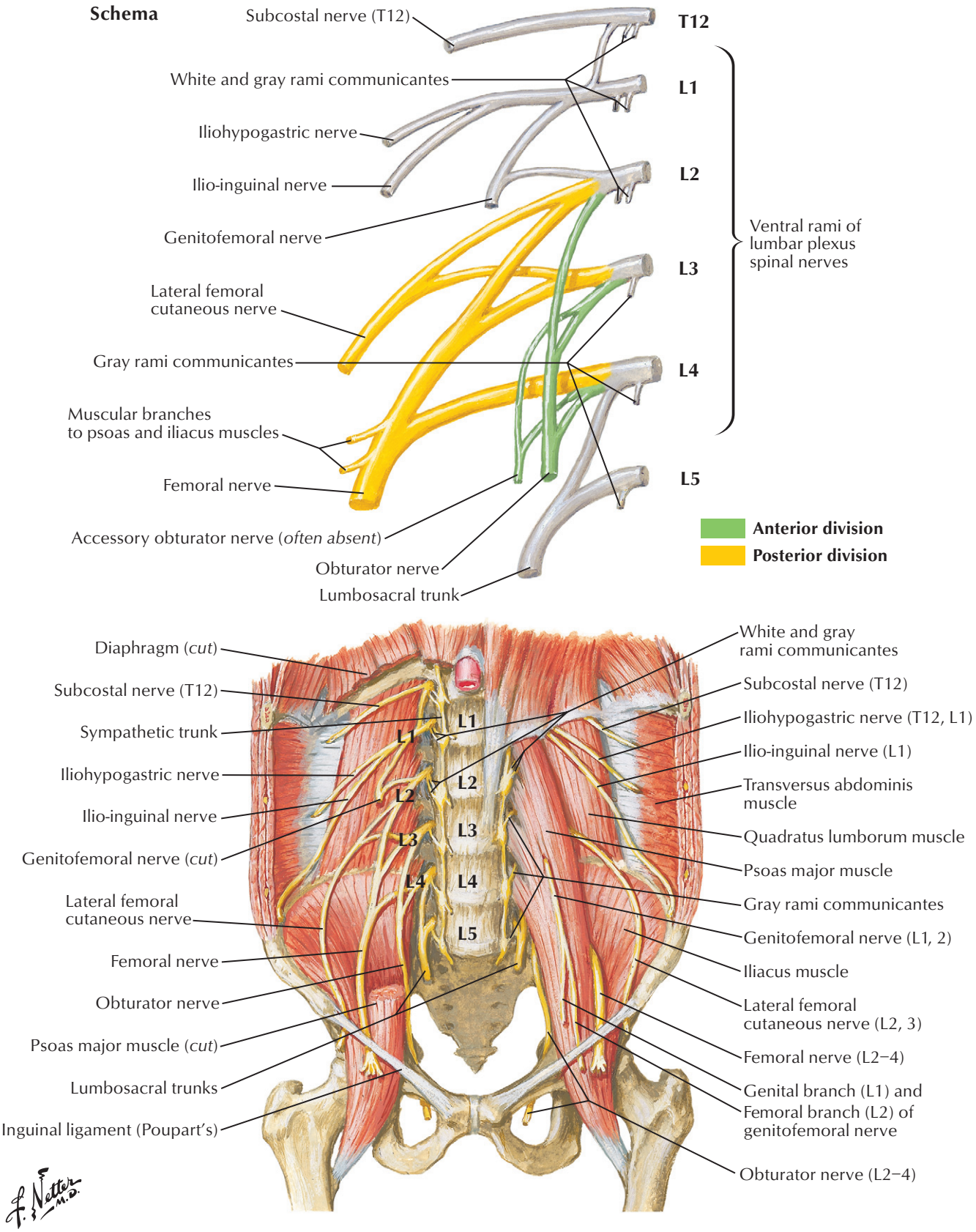
See also Plates 253, 258, 262

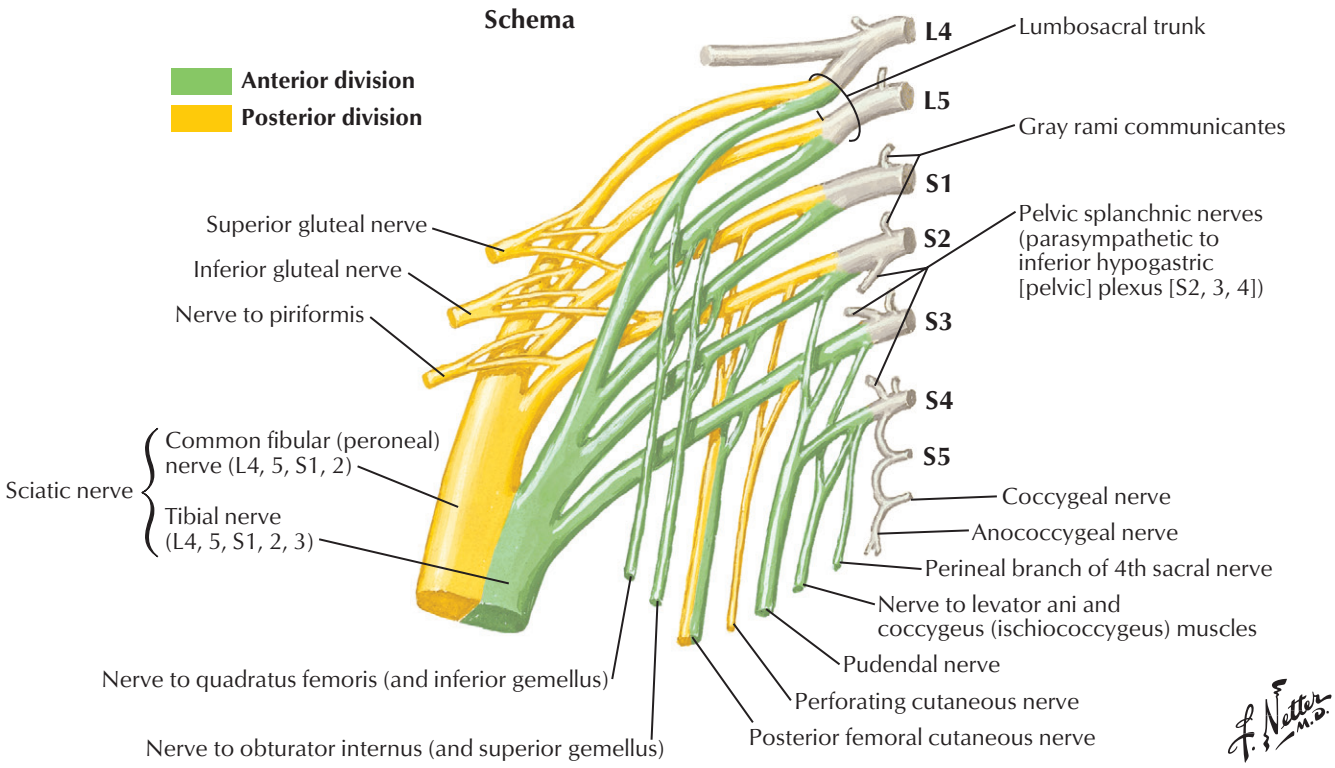


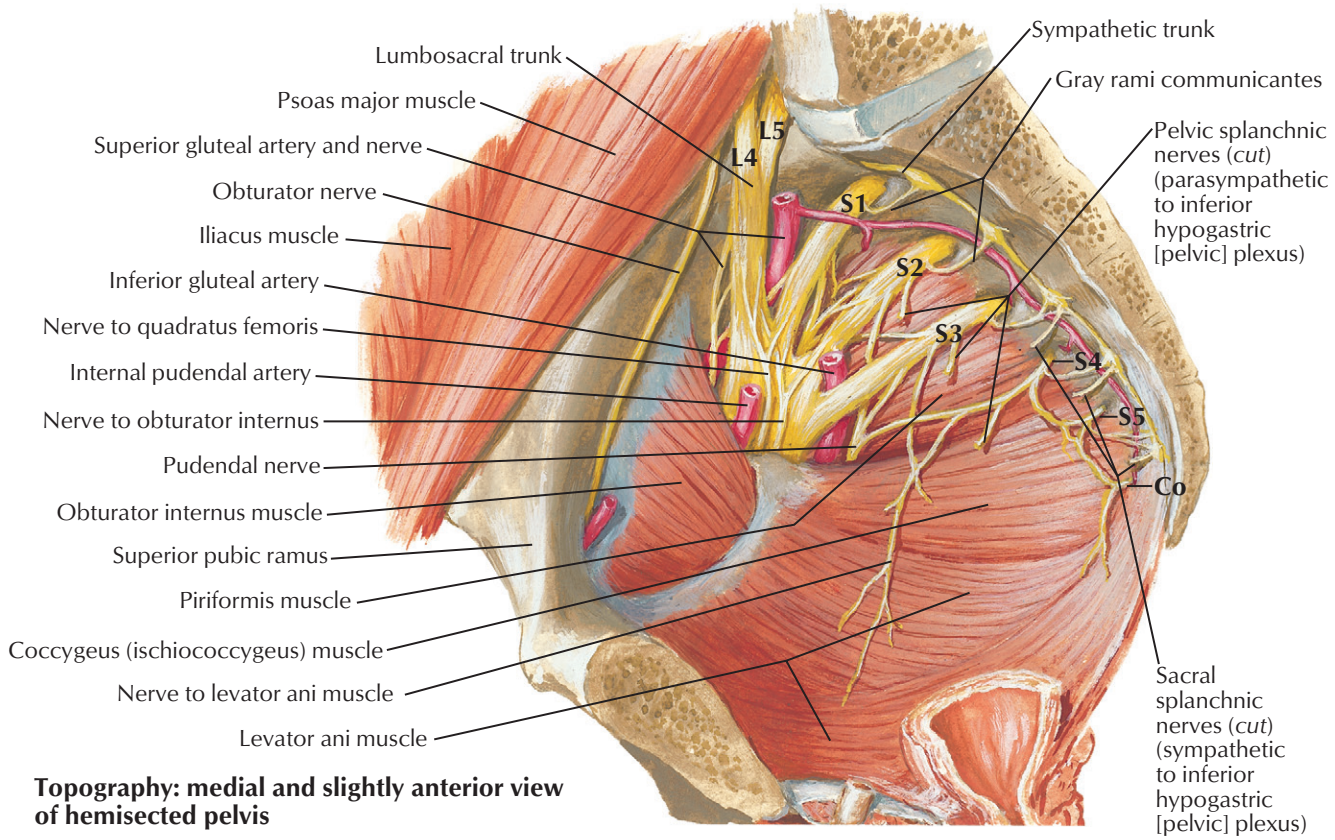

Intercostal nerve (T11)
Subcostal nerve (T12)
Iliohypogastric nerve (T12, L1)
Ilio-inguinal nerve (L1)
To psoas major and psoas minor muscles
Genitofemoral nerve (L1, 2)
Lateral femoral cutaneous nerve (L2, 3)
Genital branch (L1) and Femoral branch (L2) of genitofemoral nerve
To psoas major and iliacus muscles
Anterior branches and Lateral branches of subcostal and iliohypogastric nerves
Lumbosacral trunk
Nerve to quadratus femoris (and inferior gemellus) (L4, 5, S1)
Nerve to obturator internus (and superior gemellus) (L5, S1, 2)
Superior gluteal nerve (L4, 5, S1)
Nerve to piriformis (S1, 2)
Obturator nerve (L2, 3, 4)
Accessory obturator nerve (L3, 4) (inconstant)
Inferior gluteal nerve (L5, S1, 2)
Femoral nerve (L2, 3, 4)
Sciatic nerve
Posterior femoral cutaneous nerve (S1, 2, 3)
Pudendal nerve (S2, 3, 4)
Sciatic nerve
Common fibular (peroneal) nerve (L4, 5, S1, 2)
Tibial nerve (L4, 5, S1, 2, 3)
Rami communicantes
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
Co
Anterior division
Posterior division
Sympathetic trunk
Lumbar plexus
Sacral plexus
Coccygeal plexus
Pelvic splanchnic nerves (parasympathetics)
Perforating cutaneous nerve (S2, 3)
Nerve to levator ani and coccygeus (S3, 4)
Perineal branch of 4th sacral nerve
Anococcygeal nerves
Obturator nerve
Inferior anal (rectal) nerve
Dorsal nerve of penis/clitoris
Posterior femoral cutaneous nerve
Perineal nerve and Posterior scrotal/labial branches

Lumbar Plexus

See also Plate 262

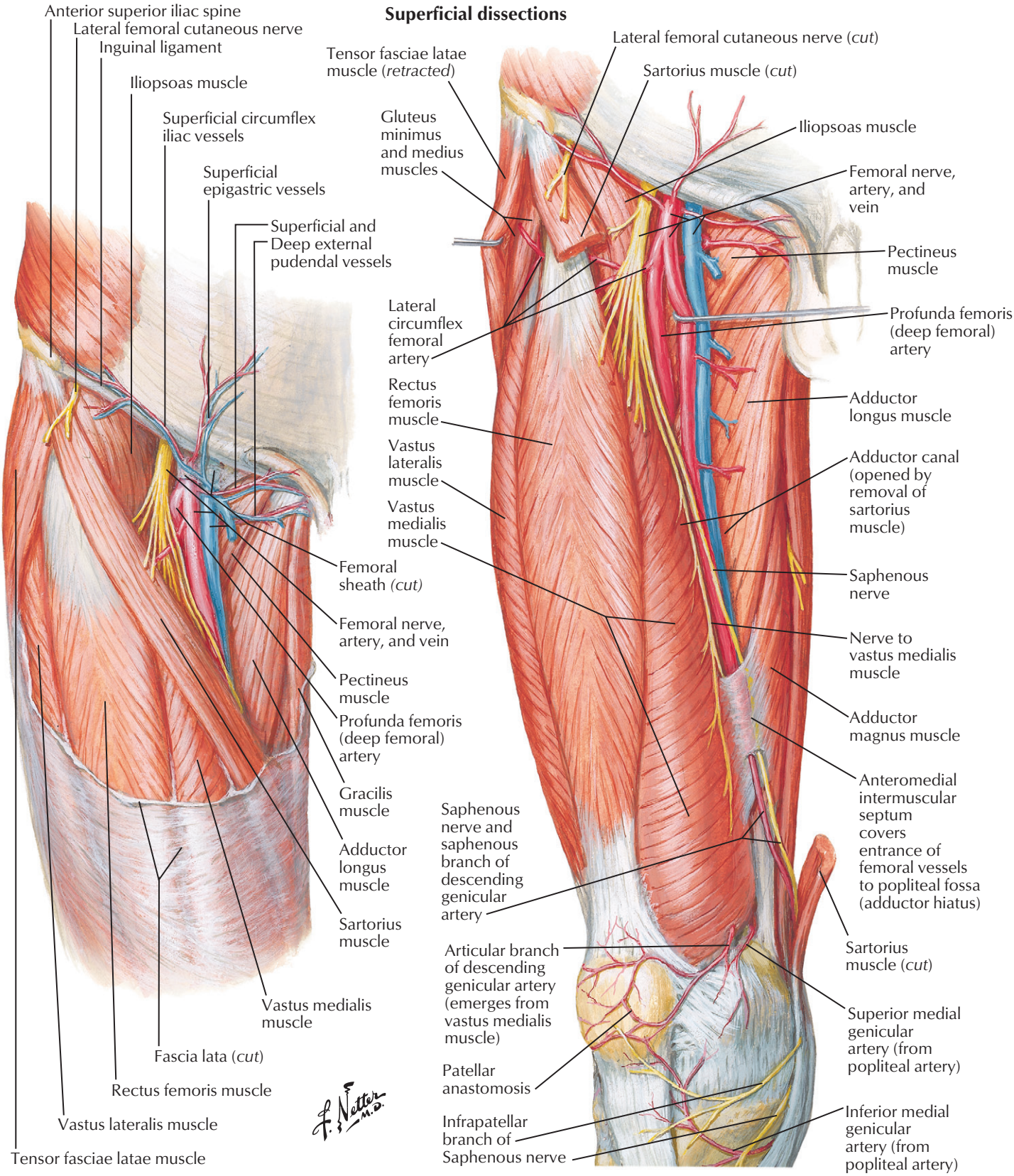




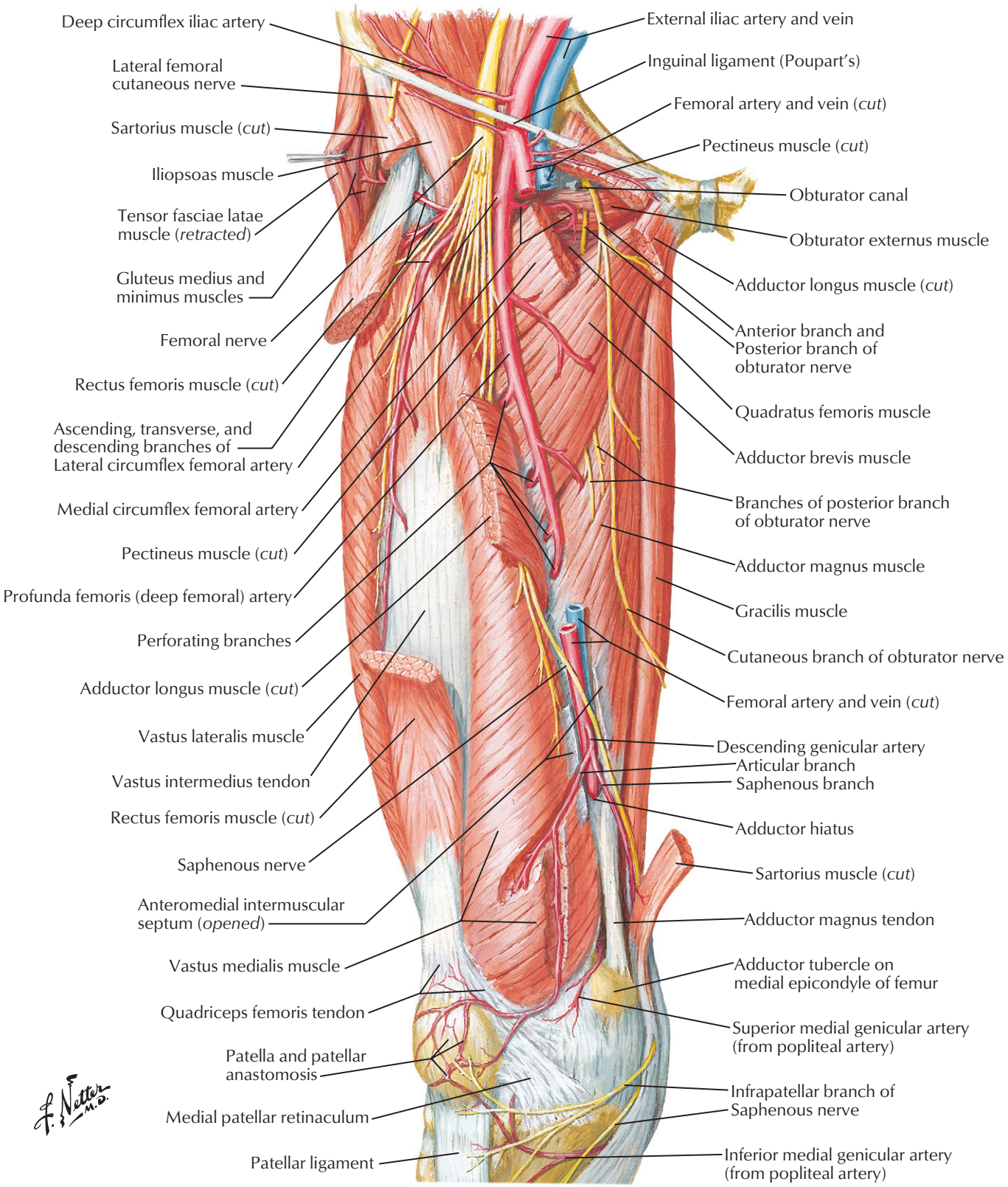


Topography: medial and slightly anterior view of hemisected pelvis

See also Plate 525



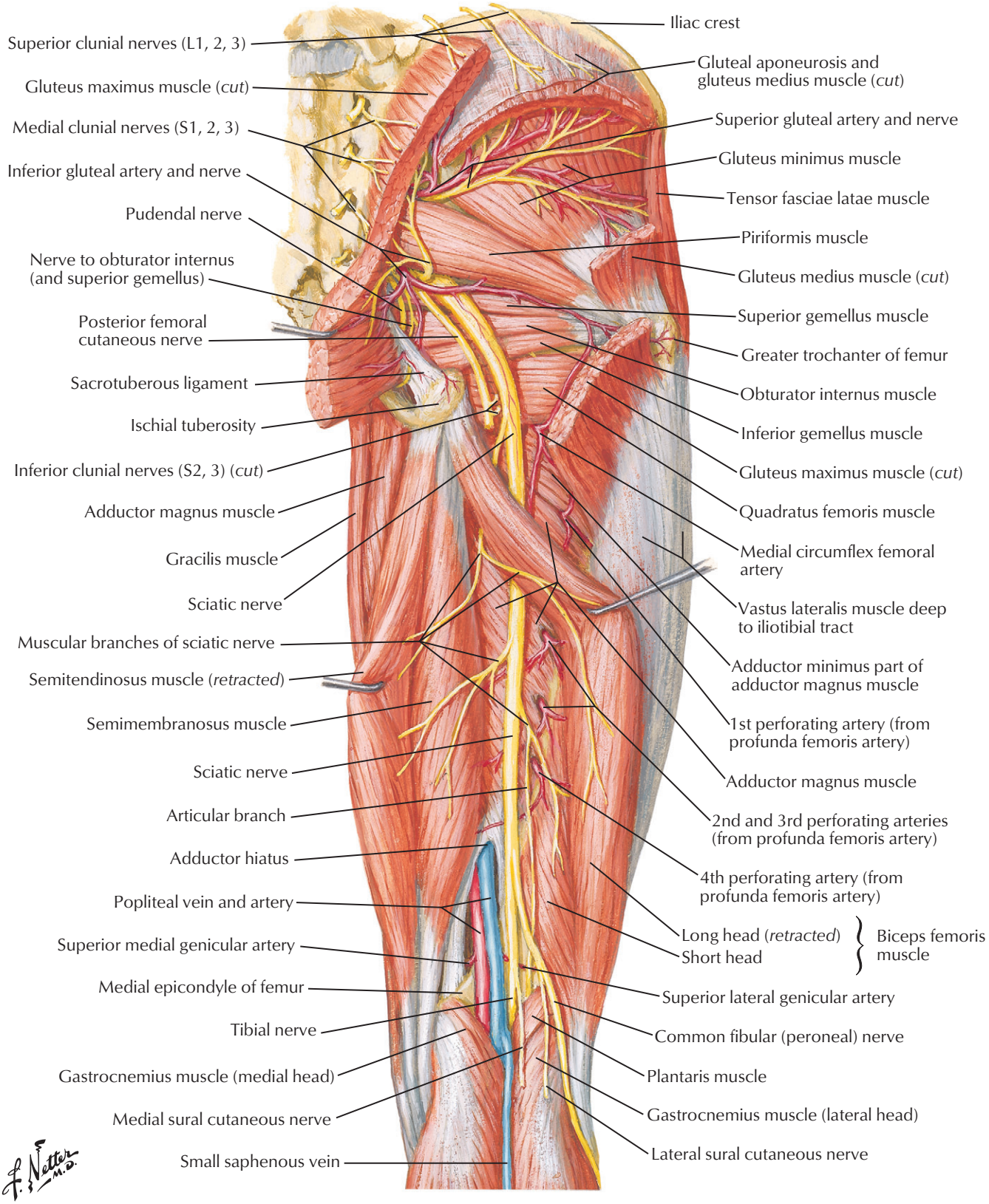
Deep dissection

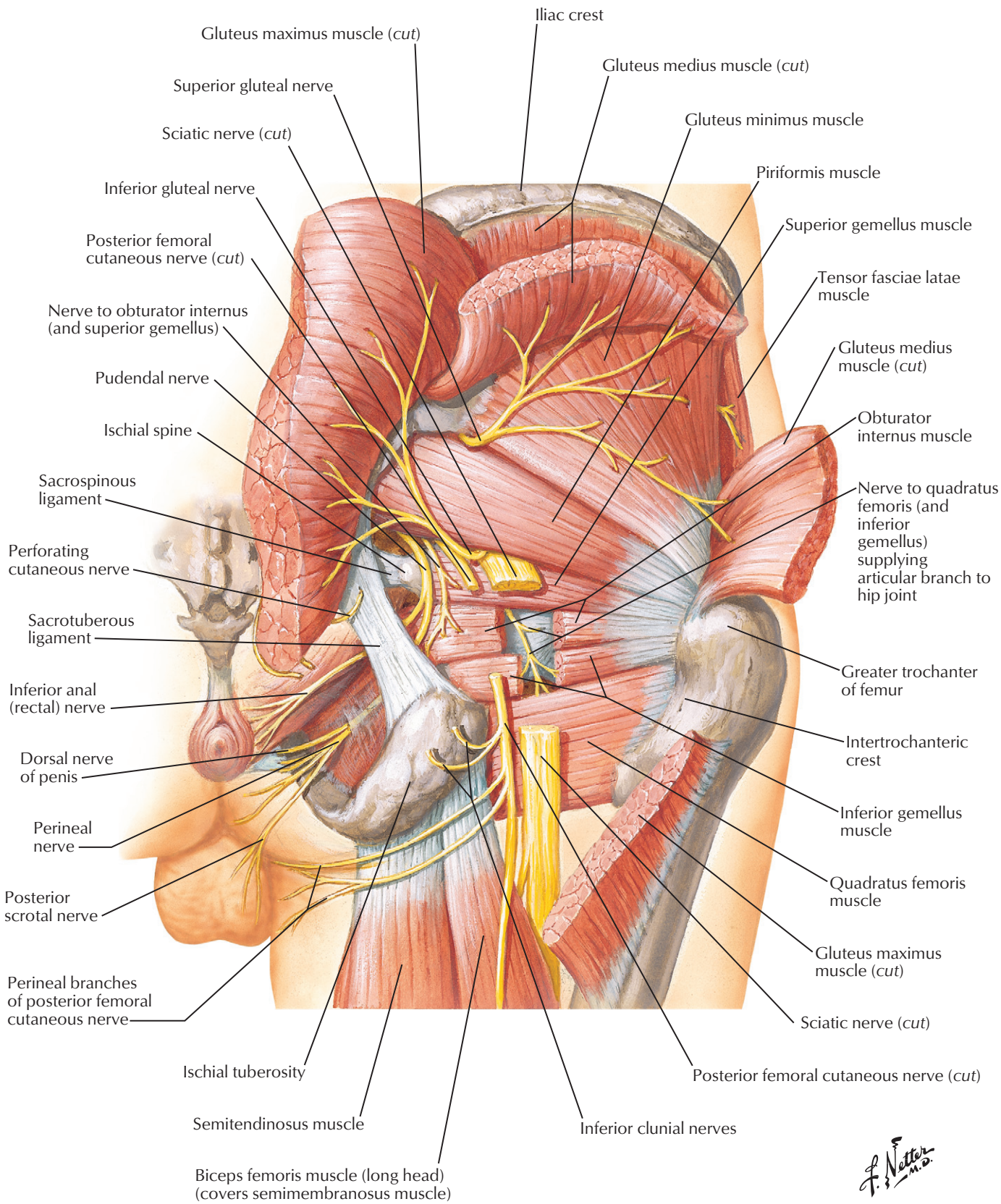


Arteries and Nerves of Thigh: Posterior View

See also Plate 527

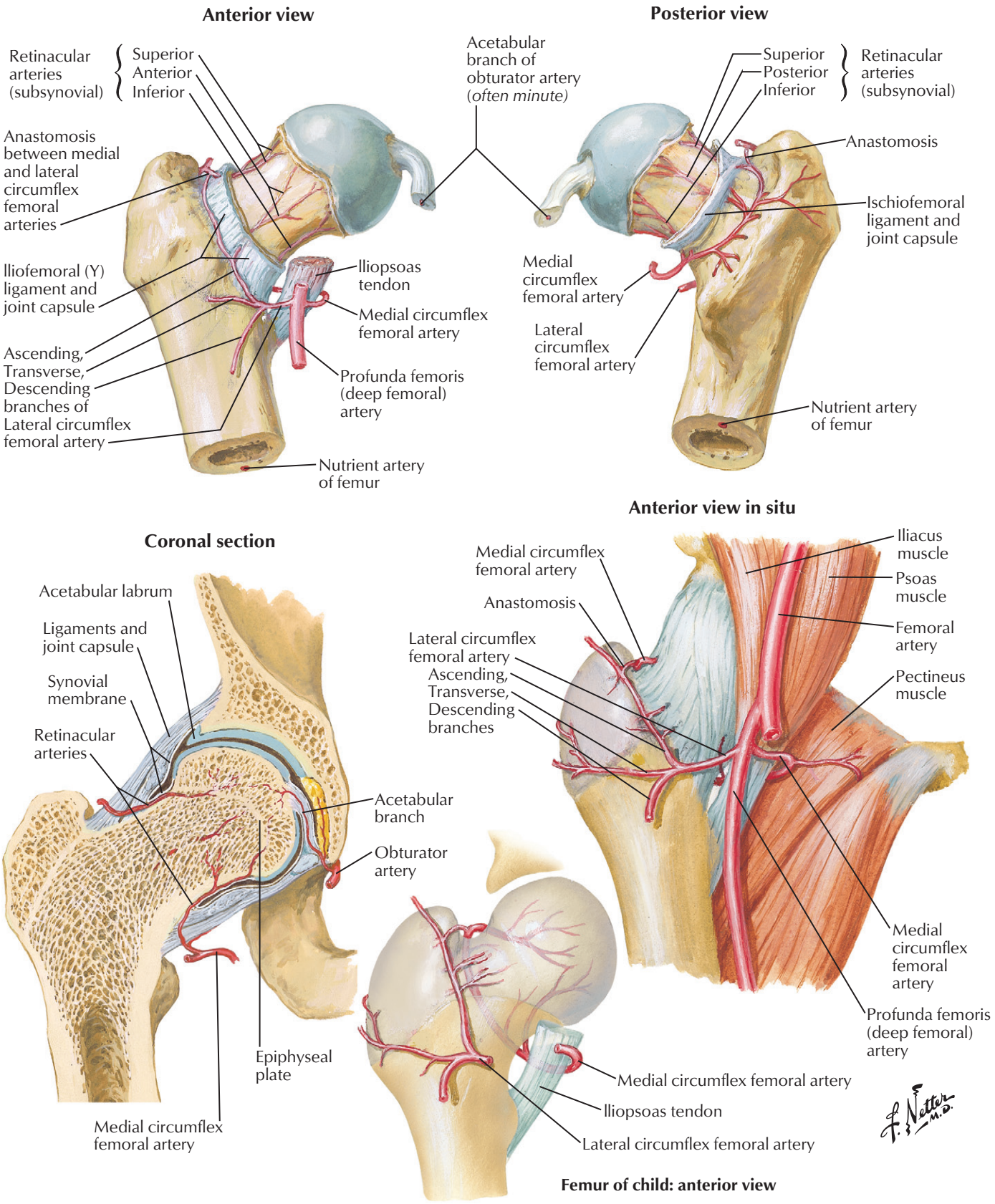
Deep dissection

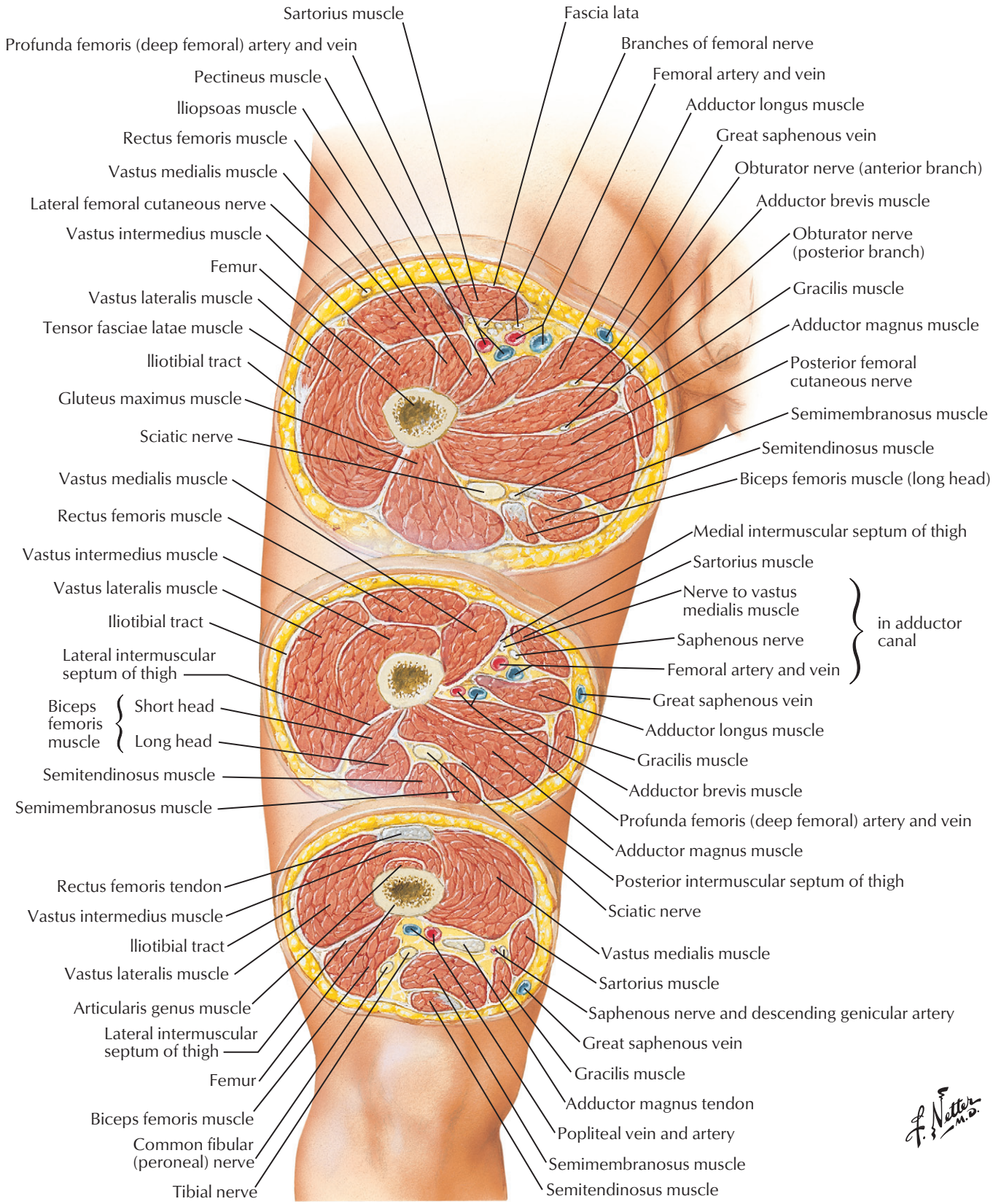



Iliac crest
Gluteus maximus muscle (*cut*)
Gluteus medius muscle (*cut*)
Superior gluteal nerve
Gluteus minimus muscle
Sciatic nerve (*cut*)
Piriformis muscle
Inferior gluteal nerve
Superior gemellus muscle
Posterior femoral cutaneous nerve (*cut*)
Tensor fasciae latae muscle
Nerve to obturator internus (and superior gemellus)
Gluteus medius muscle (*cut*)
Pudendal nerve
Obturator internus muscle
Ischial spine
Sacrospinous ligament
Nerve to quadratus femoris (and inferior gemellus) supplying articular branch to hip joint
Perforating cutaneous nerve
Sacrotuberous ligament
Greater trochanter of femur
Inferior anal (rectal) nerve
Intertrochanteric crest
Dorsal nerve of penis
Inferior gemellus muscle
Perineal nerve
Quadratus femoris muscle
Posterior scrotal nerve
Gluteus maximus muscle (*cut*)
Perineal branches of posterior femoral cutaneous nerve
Sciatic nerve (*cut*)
Ischial tuberosity
Posterior femoral cutaneous nerve (*cut*)
Semitendinosus muscle
Inferior clunial nerves
Biceps femoris muscle (long head) (covers semimembranosus muscle)

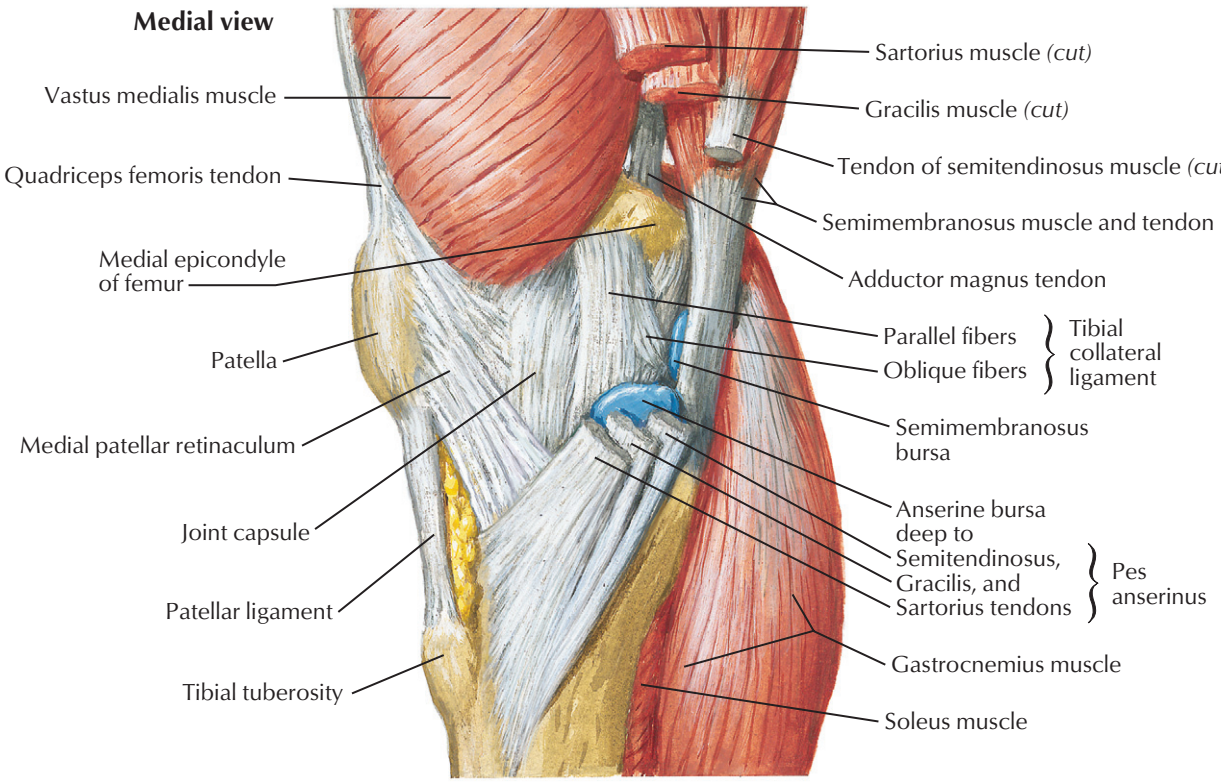
Arteries of Femoral Head and Neck

See also Plates 499, 530

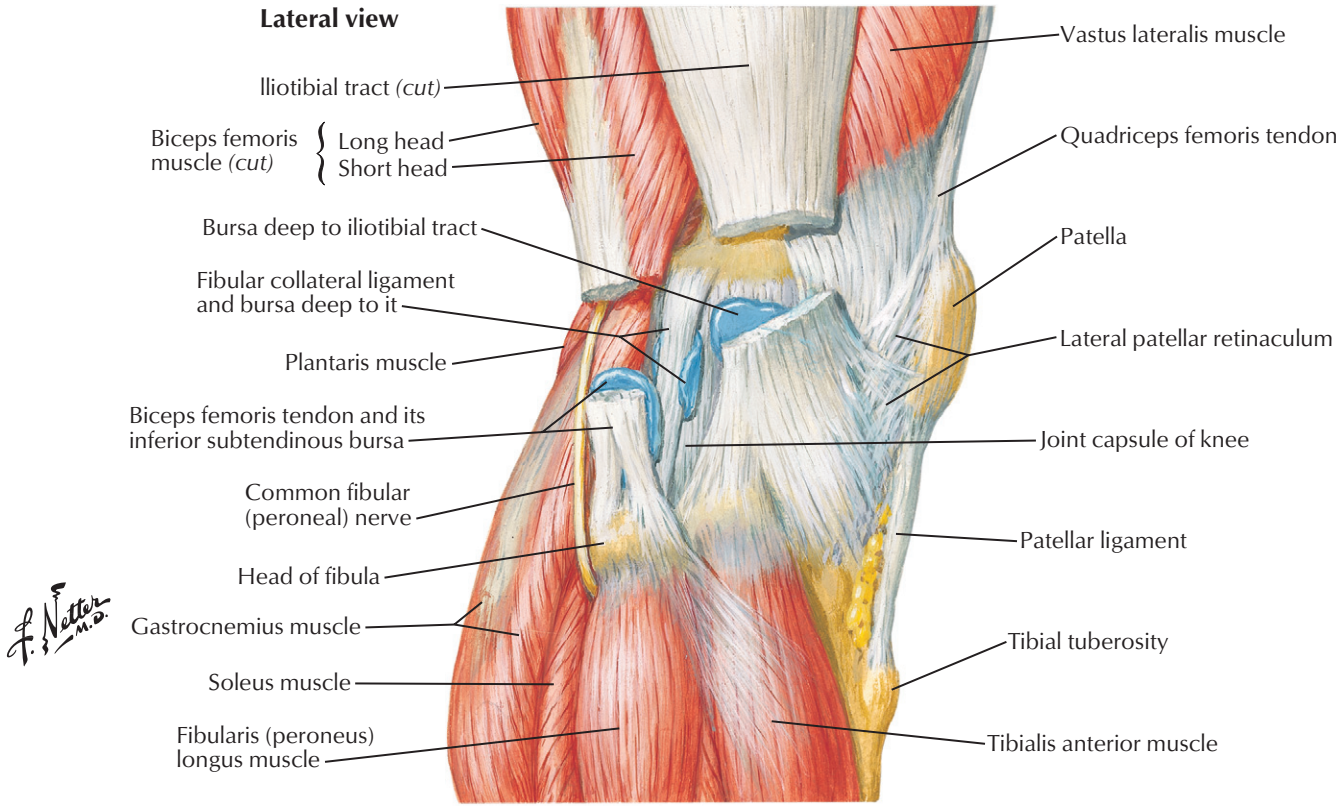



Sartorius muscle
Fascia lata
Profunda femoris (deep femoral) artery and vein
Branches of femoral nerve
Pectineus muscle
Femoral artery and vein
Iliopsoas muscle
Adductor longus muscle
Rectus femoris muscle
Great saphenous vein
Vastus medialis muscle
Obturator nerve (anterior branch)
Lateral femoral cutaneous nerve
Adductor brevis muscle
Vastus intermedius muscle
Obturator nerve (posterior branch)
Femur
Gracilis muscle
Vastus lateralis muscle
Adductor magnus muscle
Tensor fasciae latae muscle
Posterior femoral cutaneous nerve
Iliotibial tract
Semimembranosus muscle
Gluteus maximus muscle
Semitendinosus muscle
Sciatic nerve
Biceps femoris muscle (long head)
Vastus medialis muscle
Medial intermuscular septum of thigh
Rectus femoris muscle
Sartorius muscle
Vastus intermedius muscle
Nerve to vastus medialis muscle
Vastus lateralis muscle
Saphenous nerve
in adductor canal
Iliotibial tract
Femoral artery and vein
Lateral intermuscular septum of thigh
Great saphenous vein
Biceps femoris muscle
Short head
Long head
Adductor longus muscle
Gracilis muscle
Semitendinosus muscle
Adductor brevis muscle
Semimembranosus muscle
Profunda femoris (deep femoral) artery and vein
Adductor magnus muscle
Posterior intermuscular septum of thigh
Rectus femoris tendon
Sciatic nerve
Vastus intermedius muscle
Vastus medialis muscle
Iliotibial tract
Sartorius muscle
Vastus lateralis muscle
Saphenous nerve and descending genicular artery
Articularis genus muscle
Great saphenous vein
Lateral intermuscular septum of thigh
Gracilis muscle
Femur
Adductor magnus tendon
Biceps femoris muscle
Popliteal vein and artery
Common fibular (peroneal) nerve
Semimembranosus muscle
Tibial nerve
Semitendinosus muscle

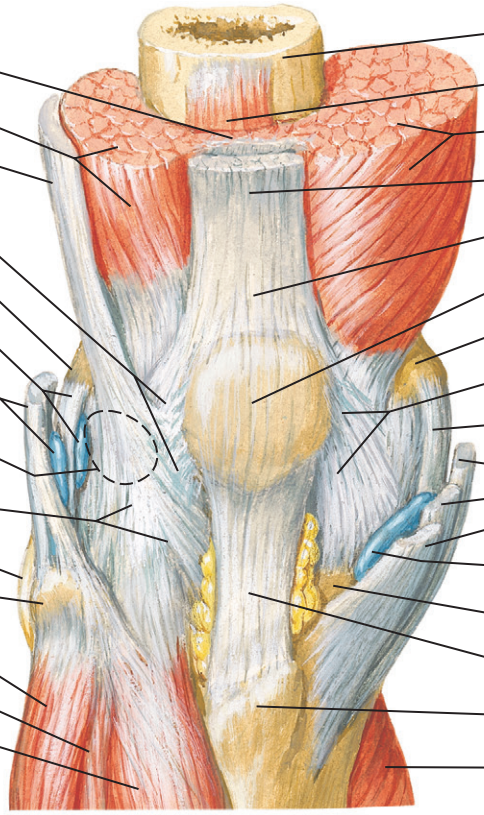
Medial view



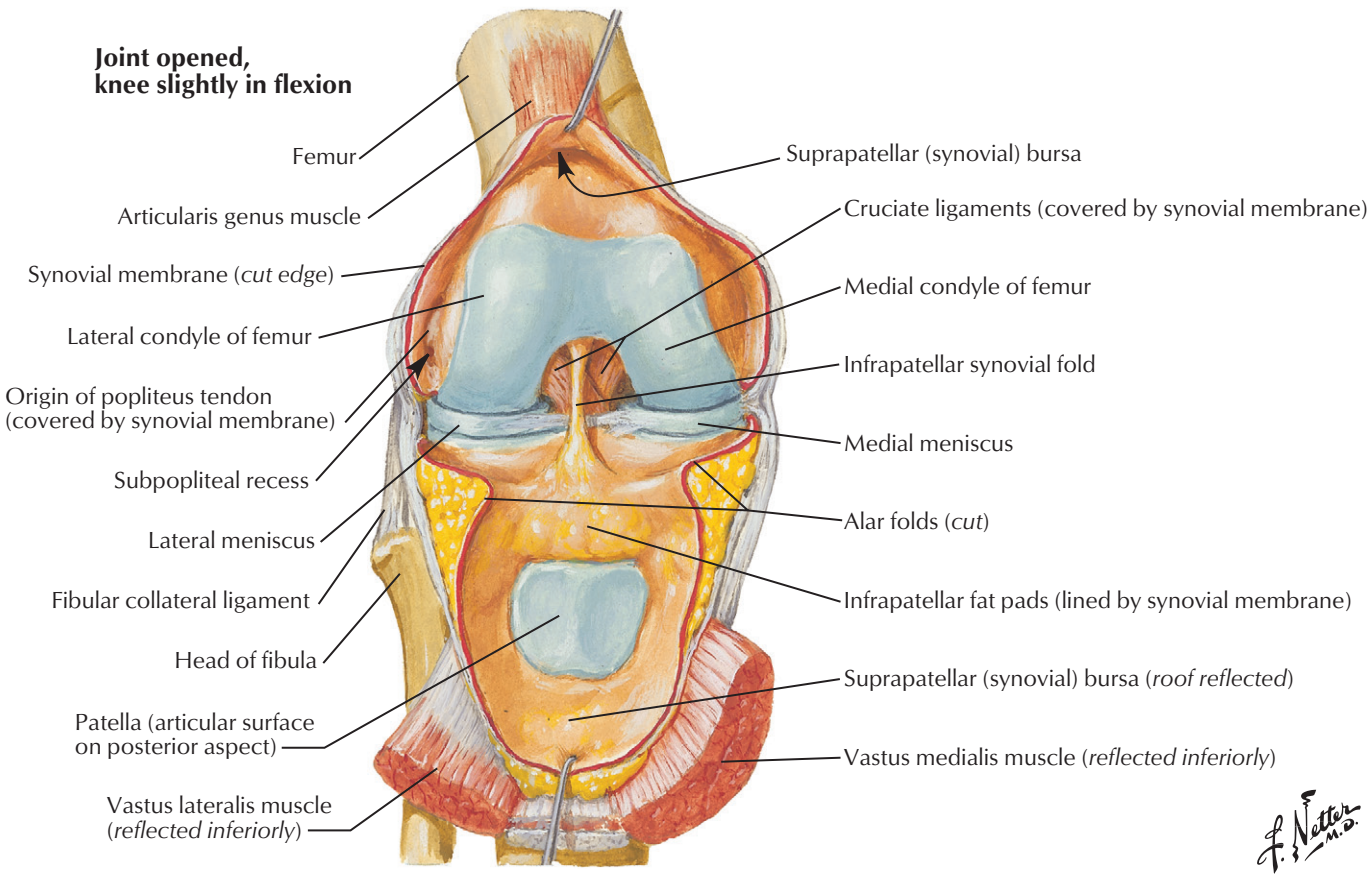
Lateral view



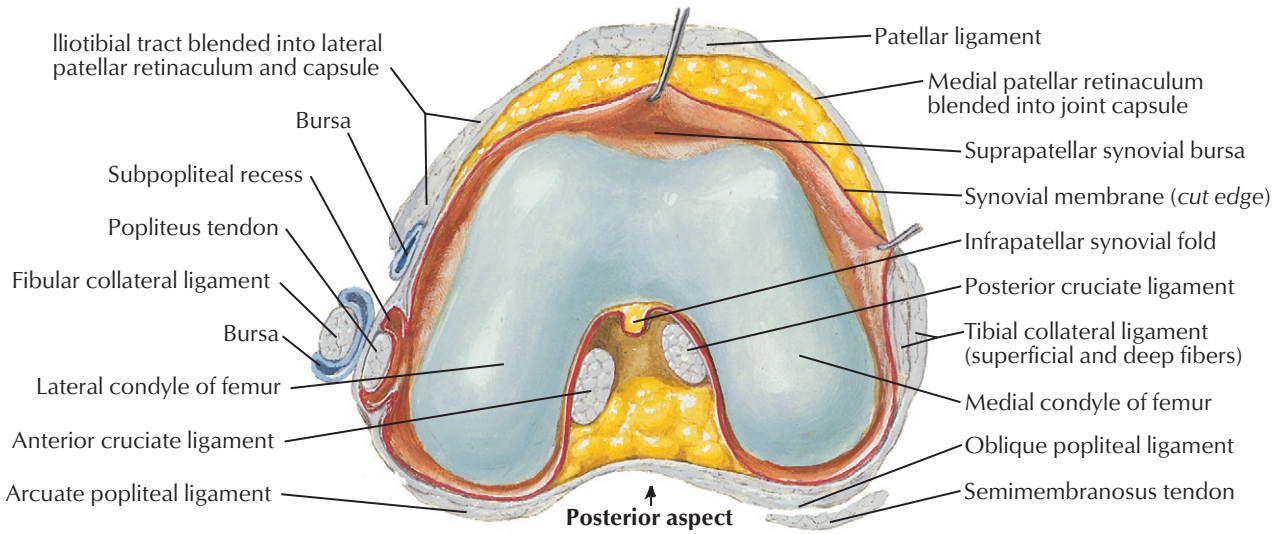
Right knee in extension



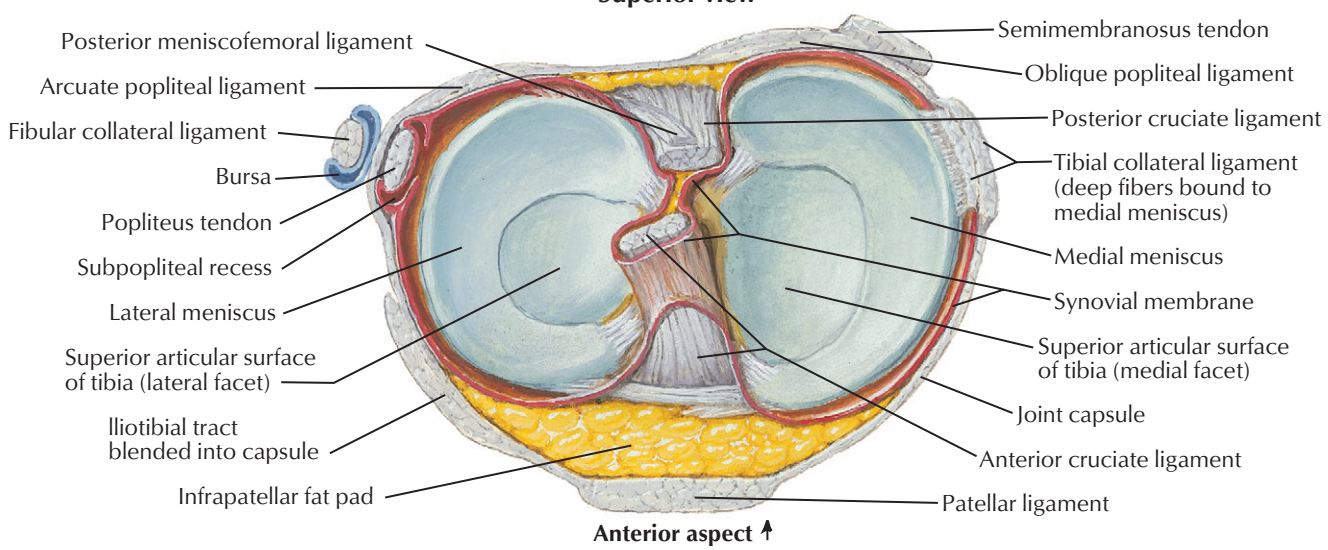
Joint opened, knee slightly in flexion



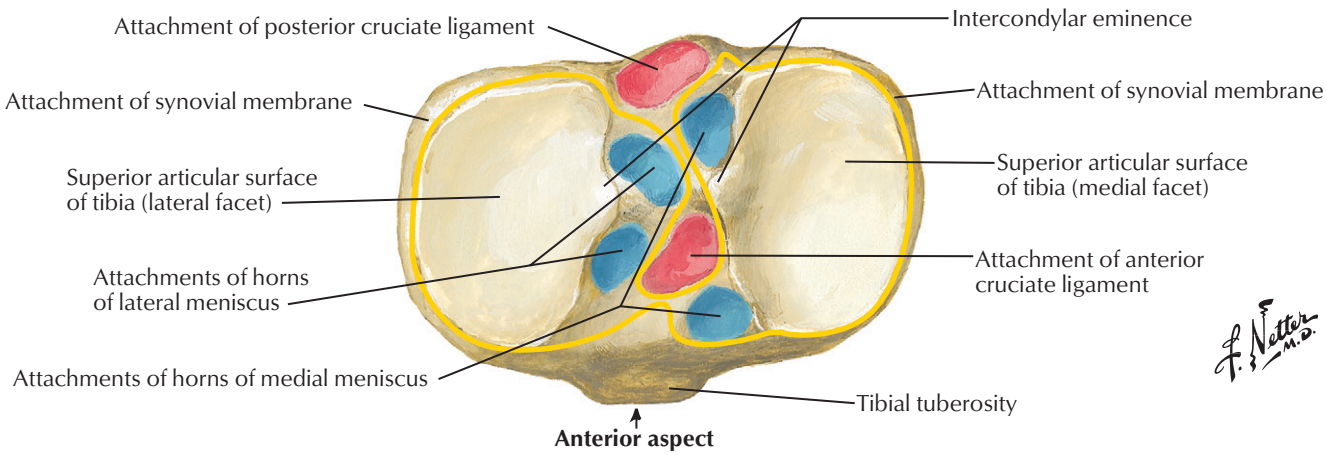
Inferior view



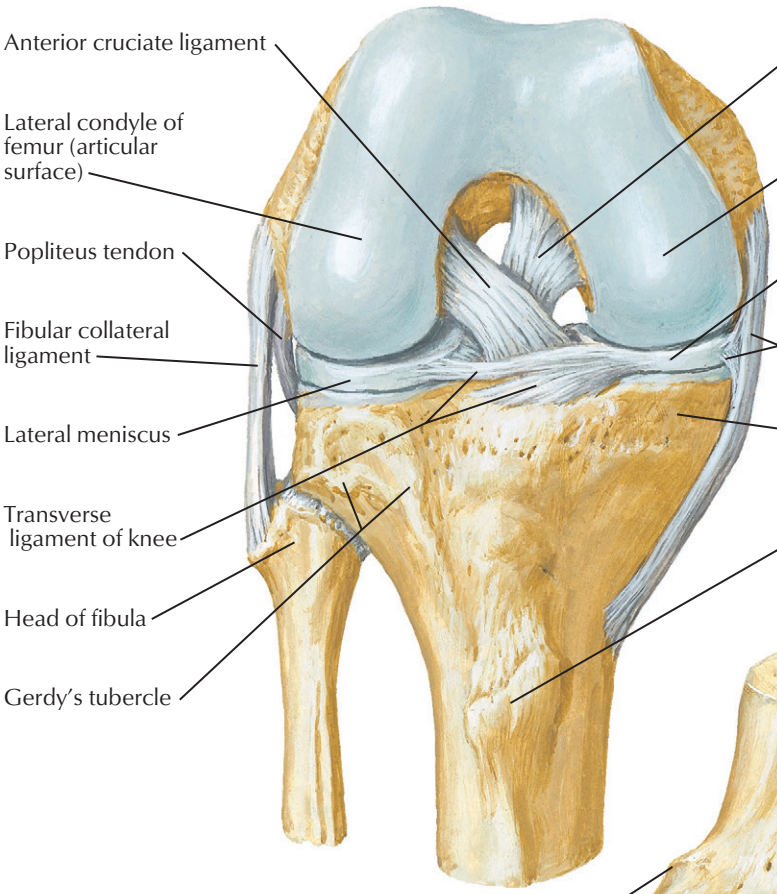
Superior view



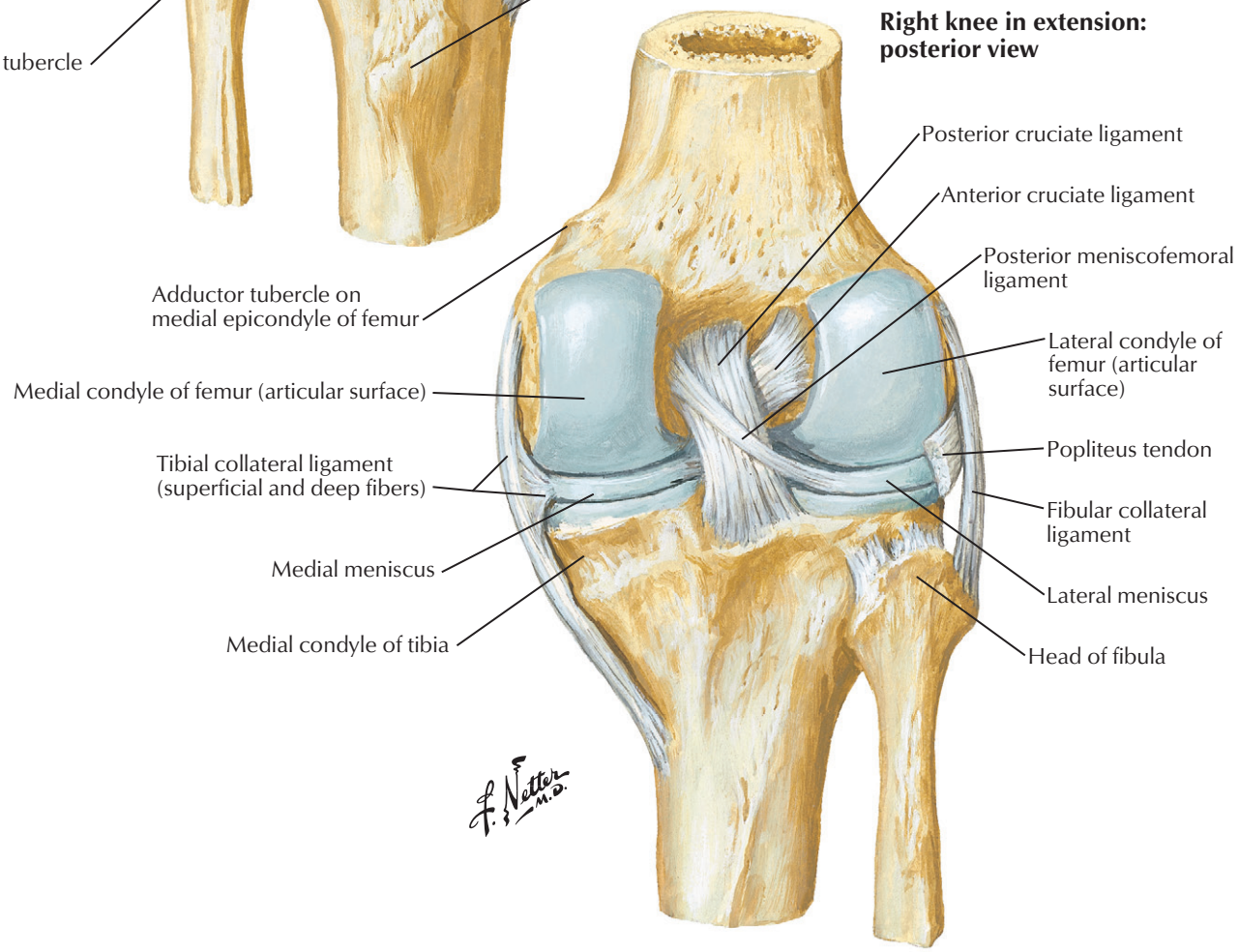
Superior view: ligaments and cartilage removed



Right knee in flexion: anterior view

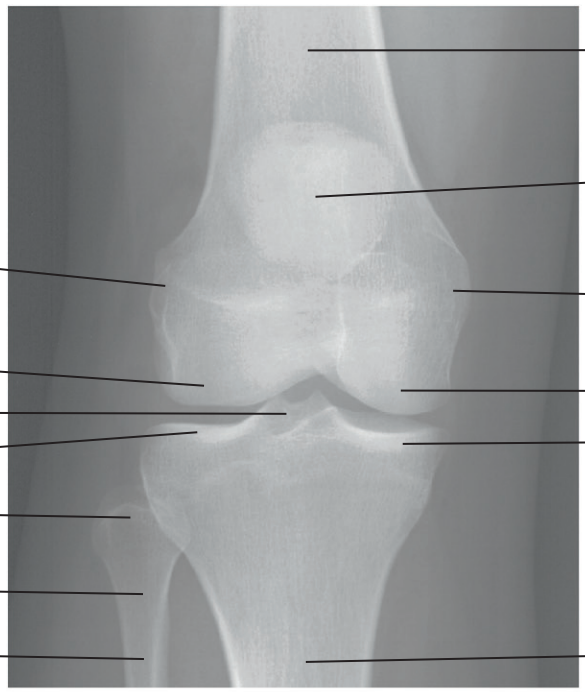


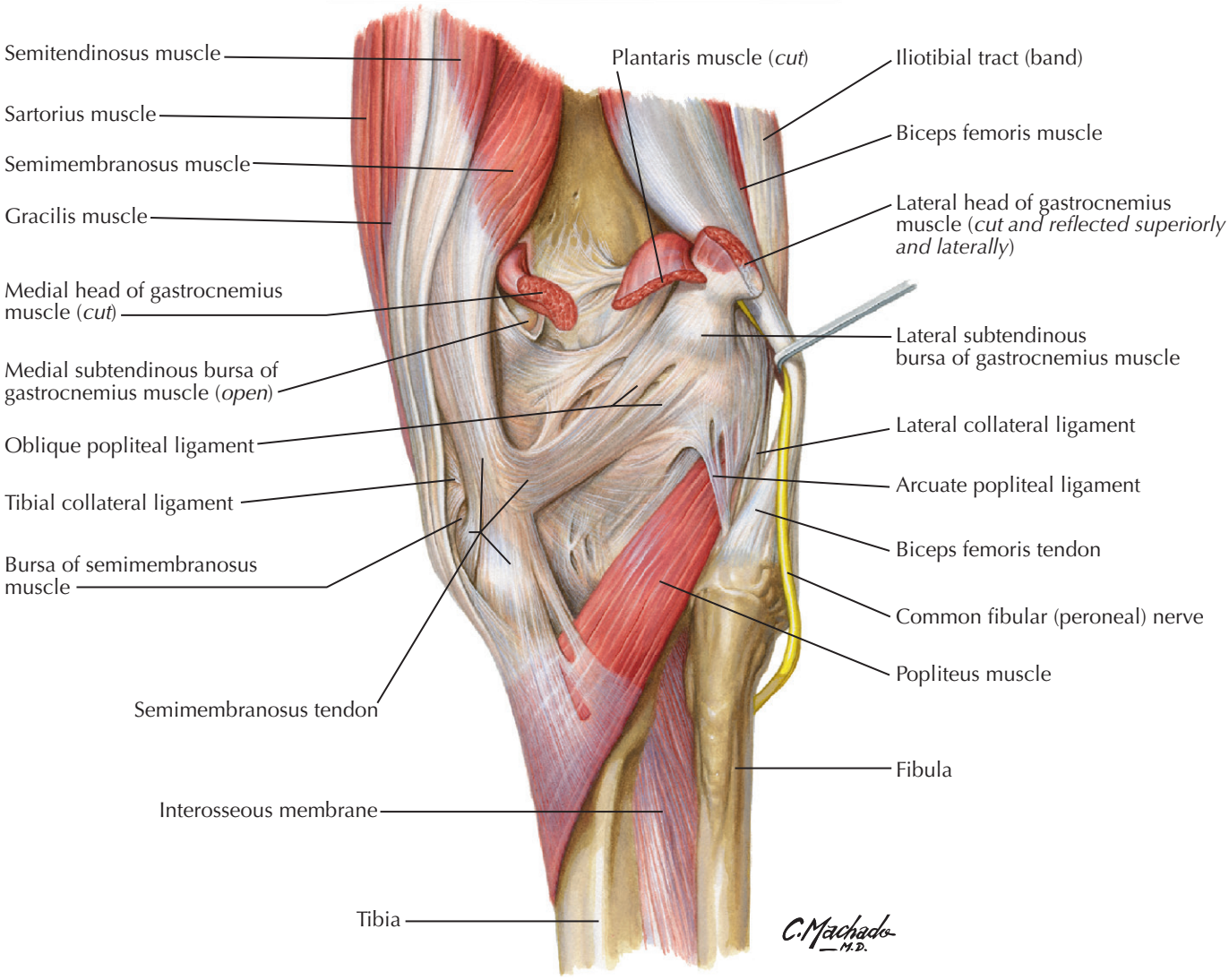
Right knee in extension: posterior view

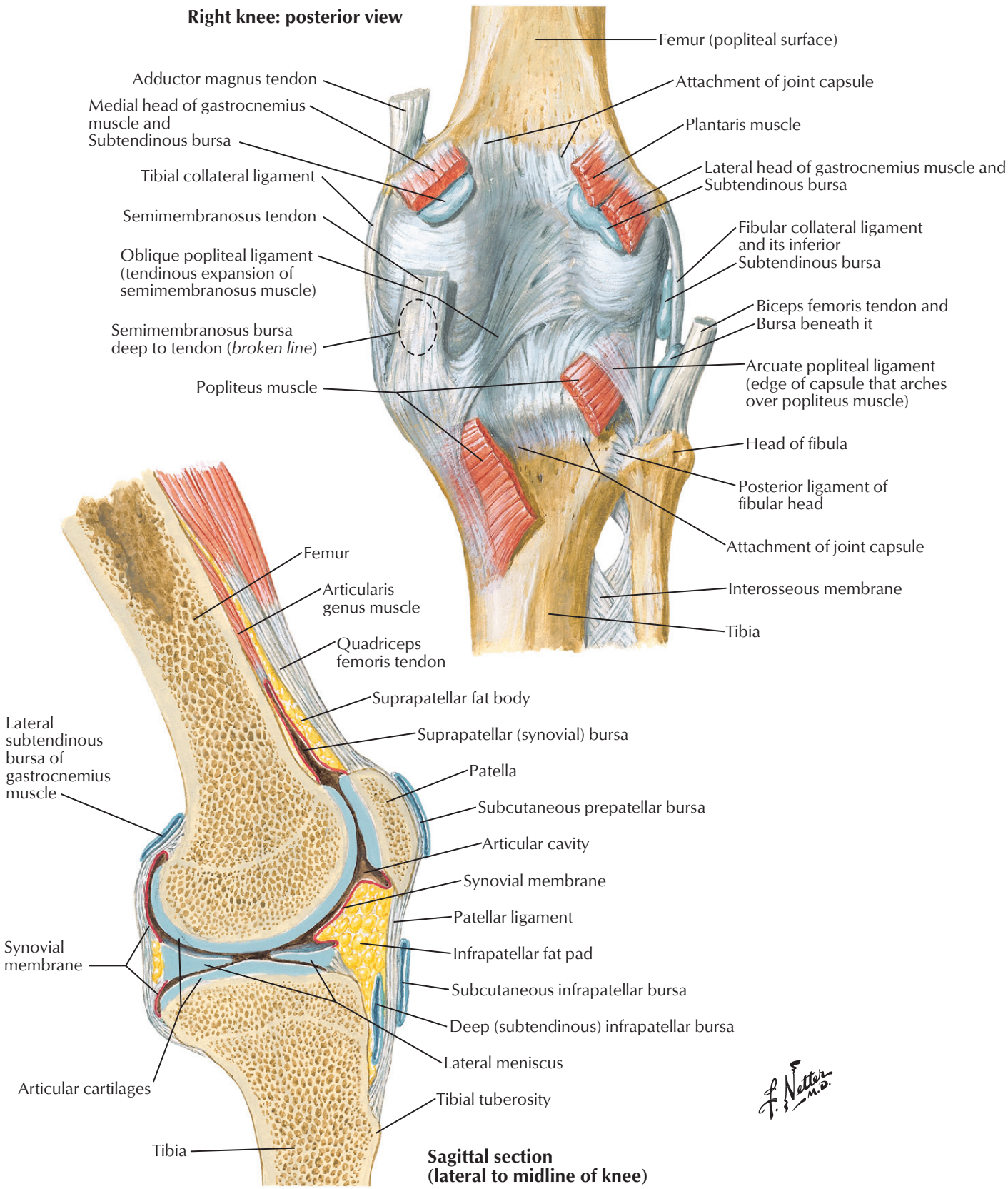


Knee: Anteroposterior Radiograph and Posterior View

See also Plate 494

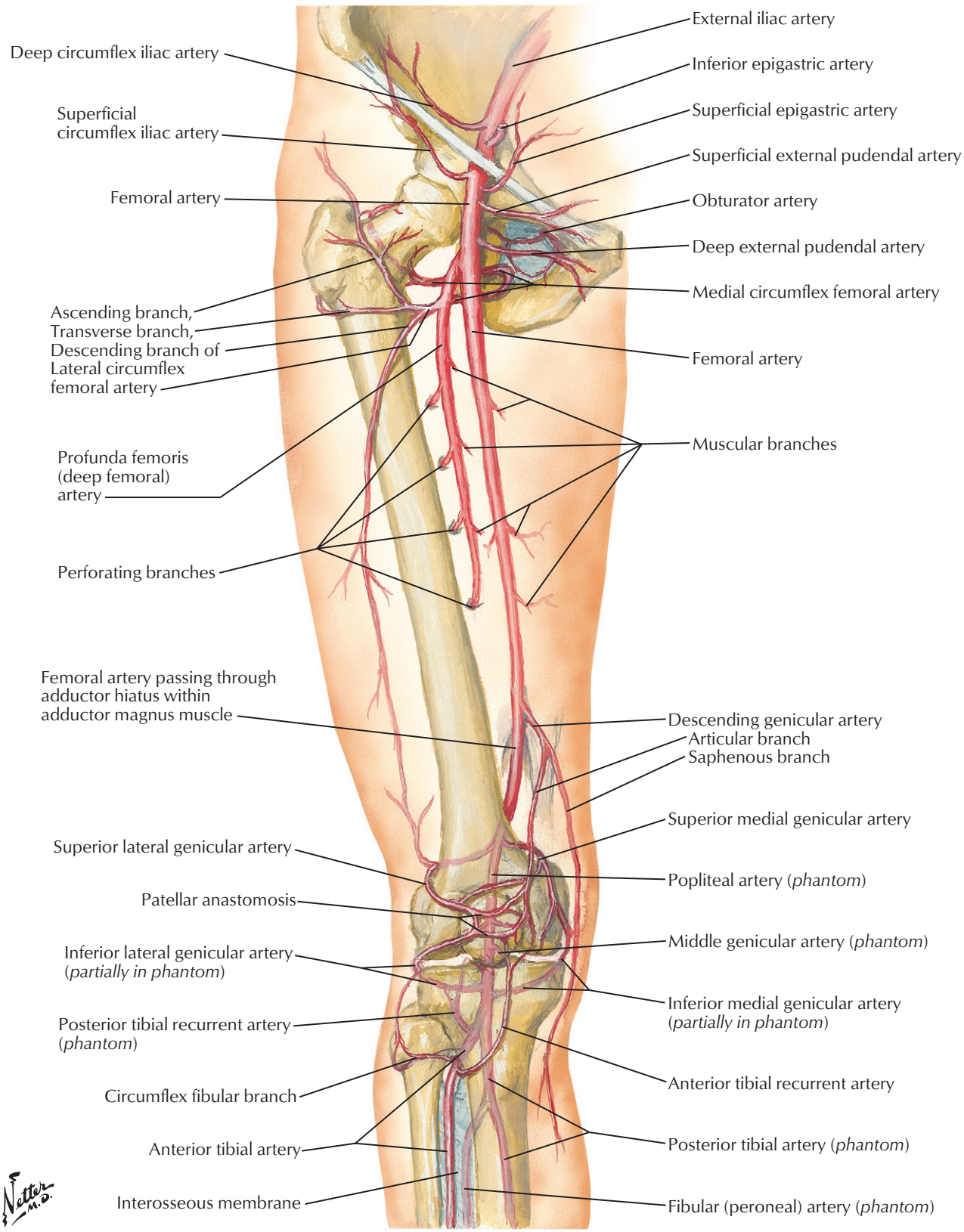


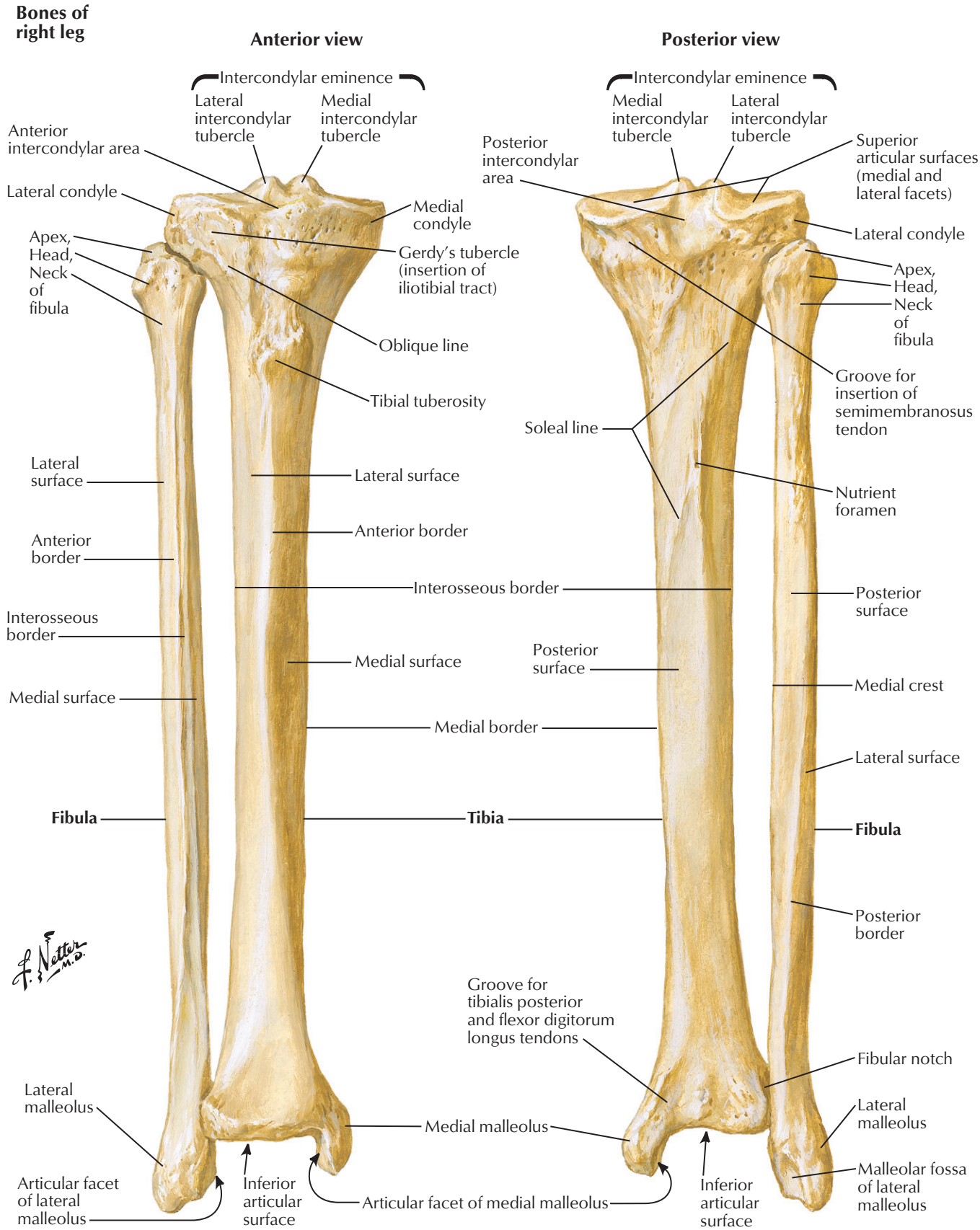



Right knee: posterior view
Femur (popliteal surface)
Attachment of joint capsule
Plantaris muscle
Lateral head of gastrocnemius muscle and Subtendinous bursa
Fibular collateral ligament and its inferior Subtendinous bursa
Biceps femoris tendon and Bursa beneath it
Arcuate popliteal ligament (edge of capsule that arches over popliteus muscle)
Head of fibula
Posterior ligament of fibular head
Attachment of joint capsule
Interosseous membrane
Tibia
Adductor magnus tendon
Medial head of gastrocnemius muscle and Subtendinous bursa
Tibial collateral ligament
Semimembranosus tendon
Oblique popliteal ligament (tendinous expansion of semimembranosus muscle)
Semimembranosus bursa deep to tendon (broken line)
Popliteus muscle
Femur
Articularis genus muscle
Quadriceps femoris tendon
Suprapatellar fat body
Suprapatellar (synovial) bursa
Patella
Subcutaneous prepatellar bursa
Articular cavity
Synovial membrane
Patellar ligament
Infrapatellar fat pad
Subcutaneous infrapatellar bursa
Deep (subtendinous) infrapatellar bursa
Lateral meniscus
Tibial tuberosity
Tibia
Lateral subtendinous bursa of gastrocnemius muscle
Synovial membrane
Articular cartilages
Sagittal section (lateral to midline of knee)

Arteries of Thigh and Knee: Schema

See also Plates 491, 508, 509, 518

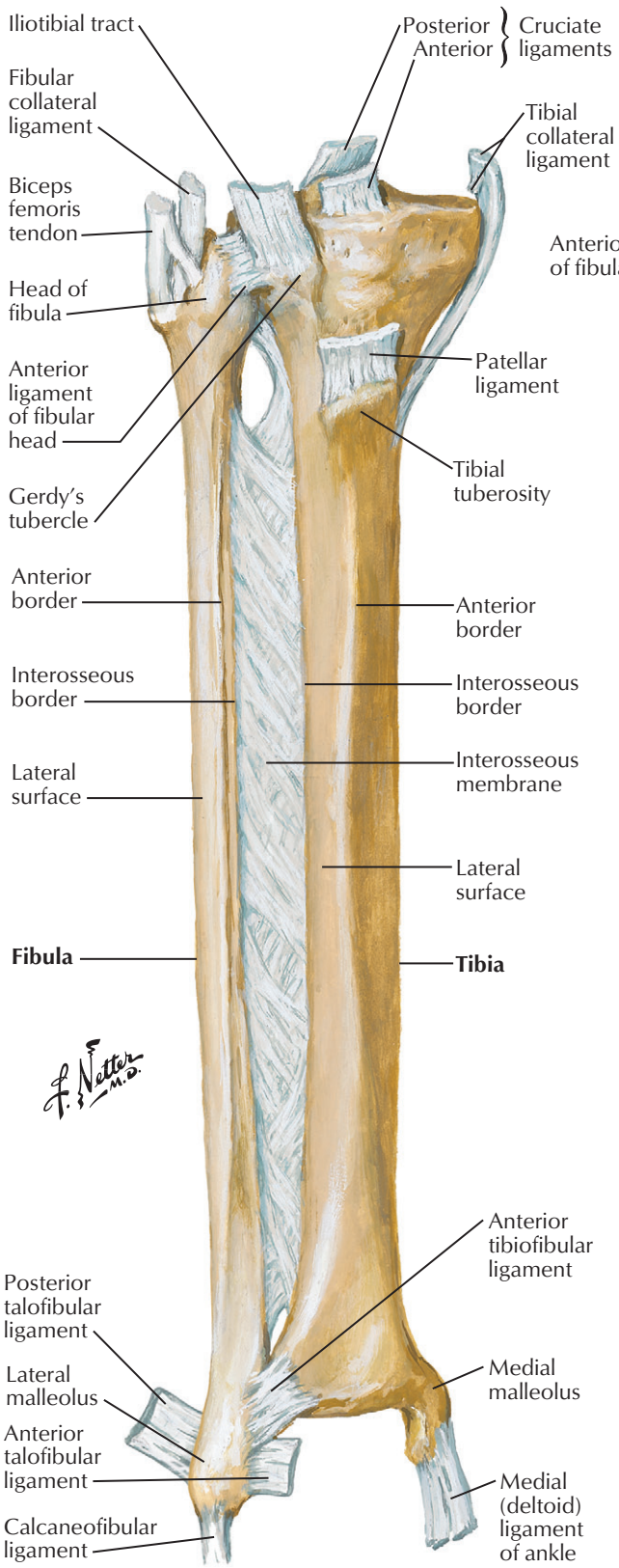



Bones of right leg
Anterior view
Posterior view
Intercondylar eminence
Lateral intercondylar tubercle
Medial intercondylar tubercle
Anterior intercondylar area
Lateral condyle
Medial condyle
Apex, Head, Neck of fibula
Gerdy's tubercle (insertion of iliotibial tract)
Oblique line
Tibial tuberosity
Lateral surface
Anterior border
Interosseous border
Medial surface
Medial border
Fibula
Tibia
Lateral malleolus
Medial malleolus
Articular facet of lateral malleolus
Inferior articular surface
Articular facet of medial malleolus
Posterior intercondylar area
Superior articular surfaces (medial and lateral facets)
Groove for insertion of semimembranosus tendon
Soleal line
Nutrient foramen
Posterior surface
Medial crest
Posterior border
Groove for tibialis posterior and flexor digitorum longus tendons
Fibular notch
Malleolar fossa of lateral malleolus

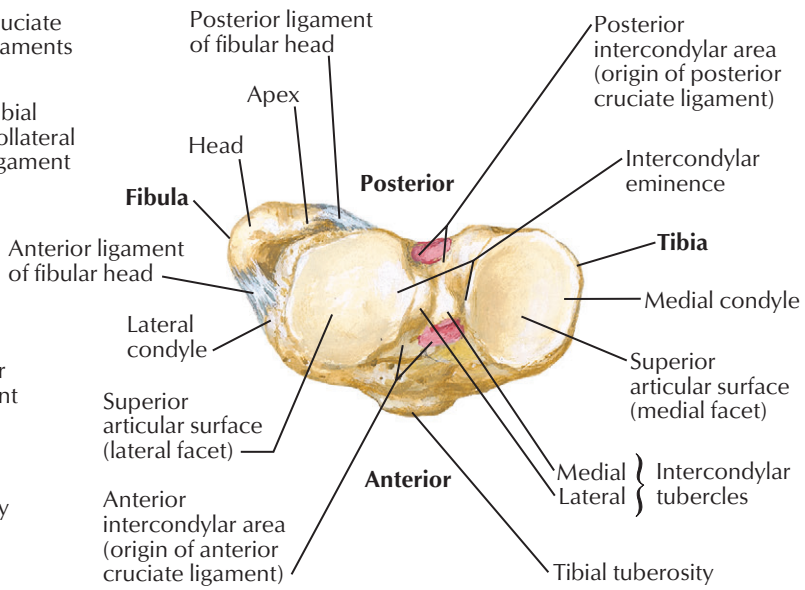
Tibia and Fibula (continued)

See also Plate 495

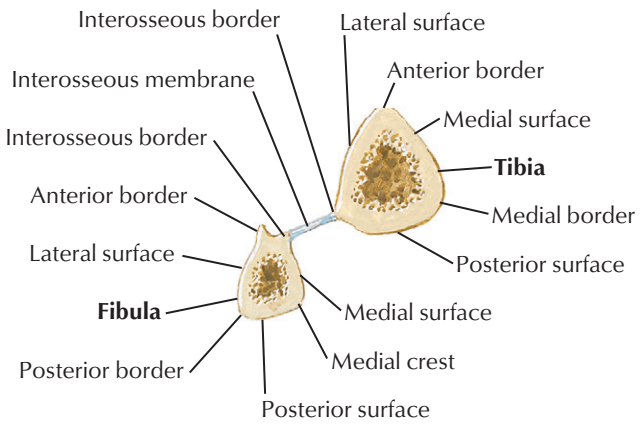
Anterior view with ligament attachments



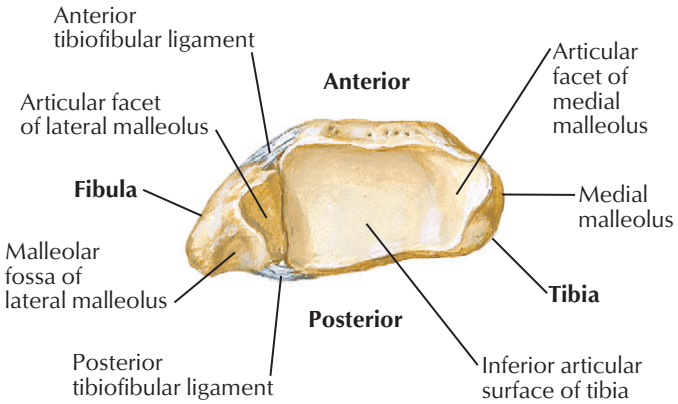
Superior view

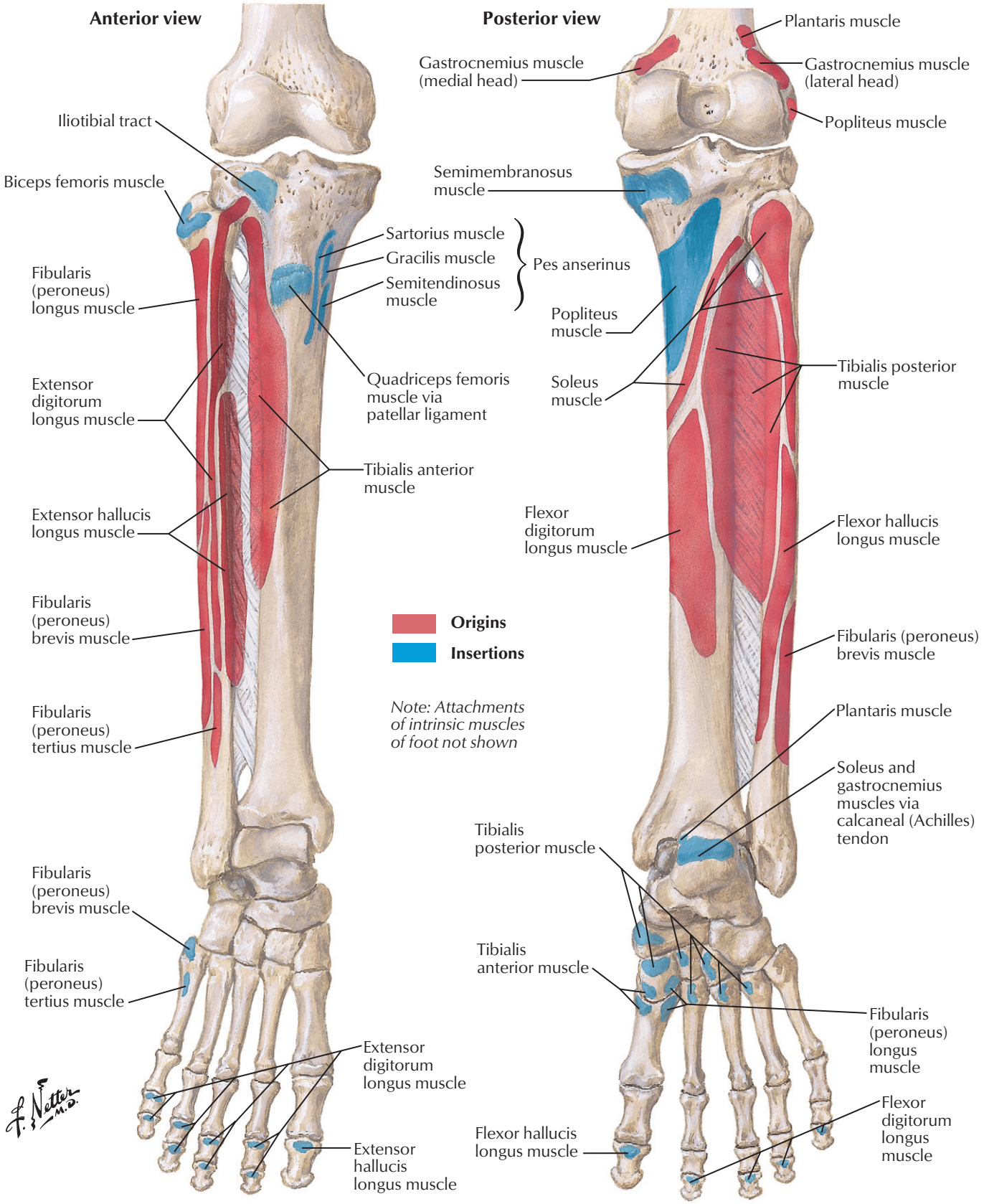


Cross section



Inferior view

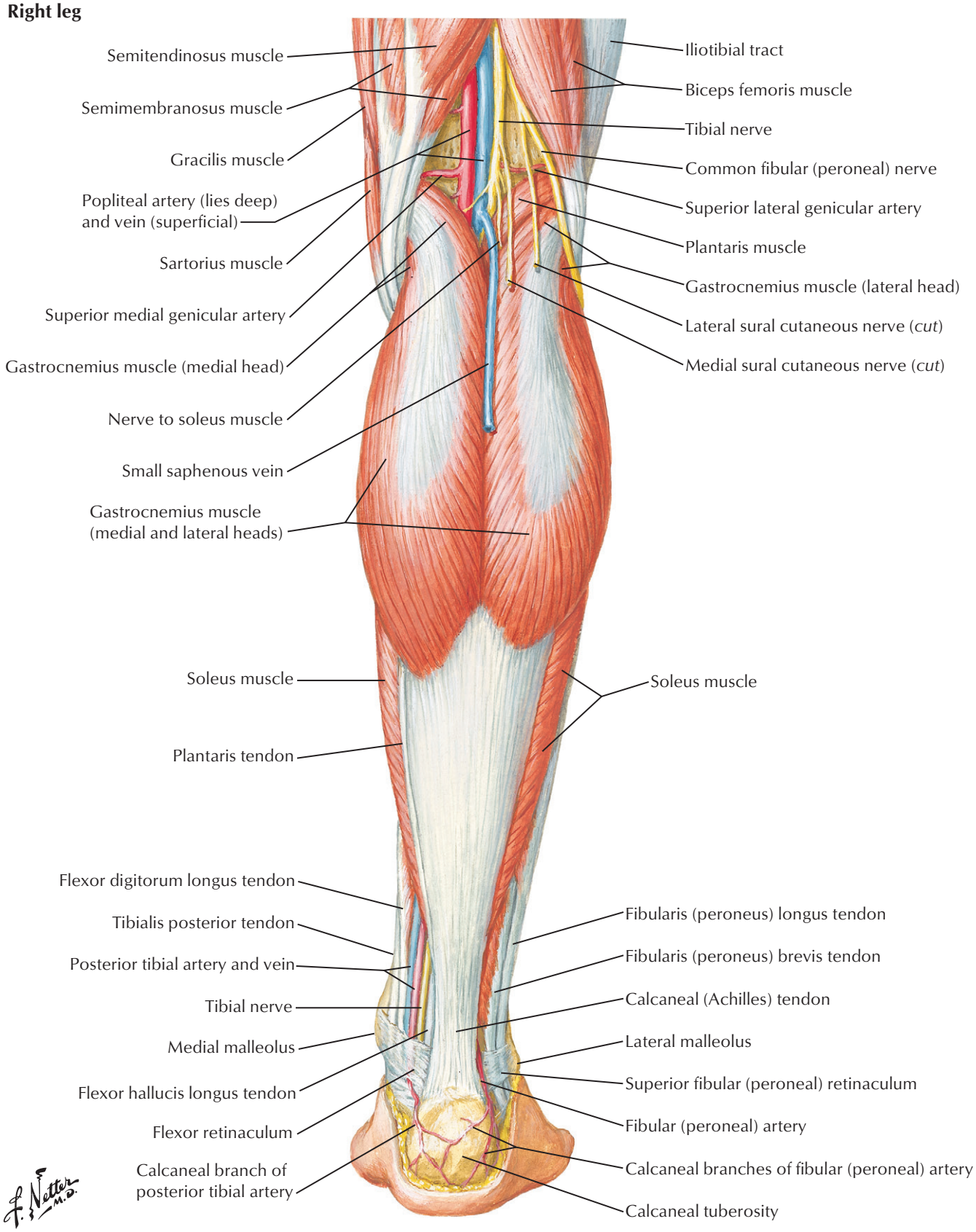



Anterior view
Posterior view
Iliotibial tract
Biceps femoris muscle
Fibularis (peroneus) longus muscle
Extensor digitorum longus muscle
Extensor hallucis longus muscle
Fibularis (peroneus) brevis muscle
Fibularis (peroneus) tertius muscle
Fibularis (peroneus) brevis muscle
Fibularis (peroneus) tertius muscle
Extensor digitorum longus muscle
Extensor hallucis longus muscle
Sartorius muscle
Gracilis muscle
Semitendinosus muscle
Pes anserinus
Quadriceps femoris muscle via patellar ligament
Tibialis anterior muscle
Origins
Insertions
Note: Attachments of intrinsic muscles of foot not shown
Gastrocnemius muscle (medial head)
Plantaris muscle
Gastrocnemius muscle (lateral head)
Popliteus muscle
Semimembranosus muscle
Popliteus muscle
Soleus muscle
Tibialis posterior muscle
Flexor digitorum longus muscle
Flexor hallucis longus muscle
Fibularis (peroneus) brevis muscle
Plantaris muscle
Soleus and gastrocnemius muscles via calcaneal (Achilles) tendon
Tibialis posterior muscle
Tibialis anterior muscle
Fibularis (peroneus) longus muscle
Flexor digitorum longus muscle
Flexor hallucis longus muscle

Muscles of Leg (Superficial Dissection): Posterior View

See also Plate 528

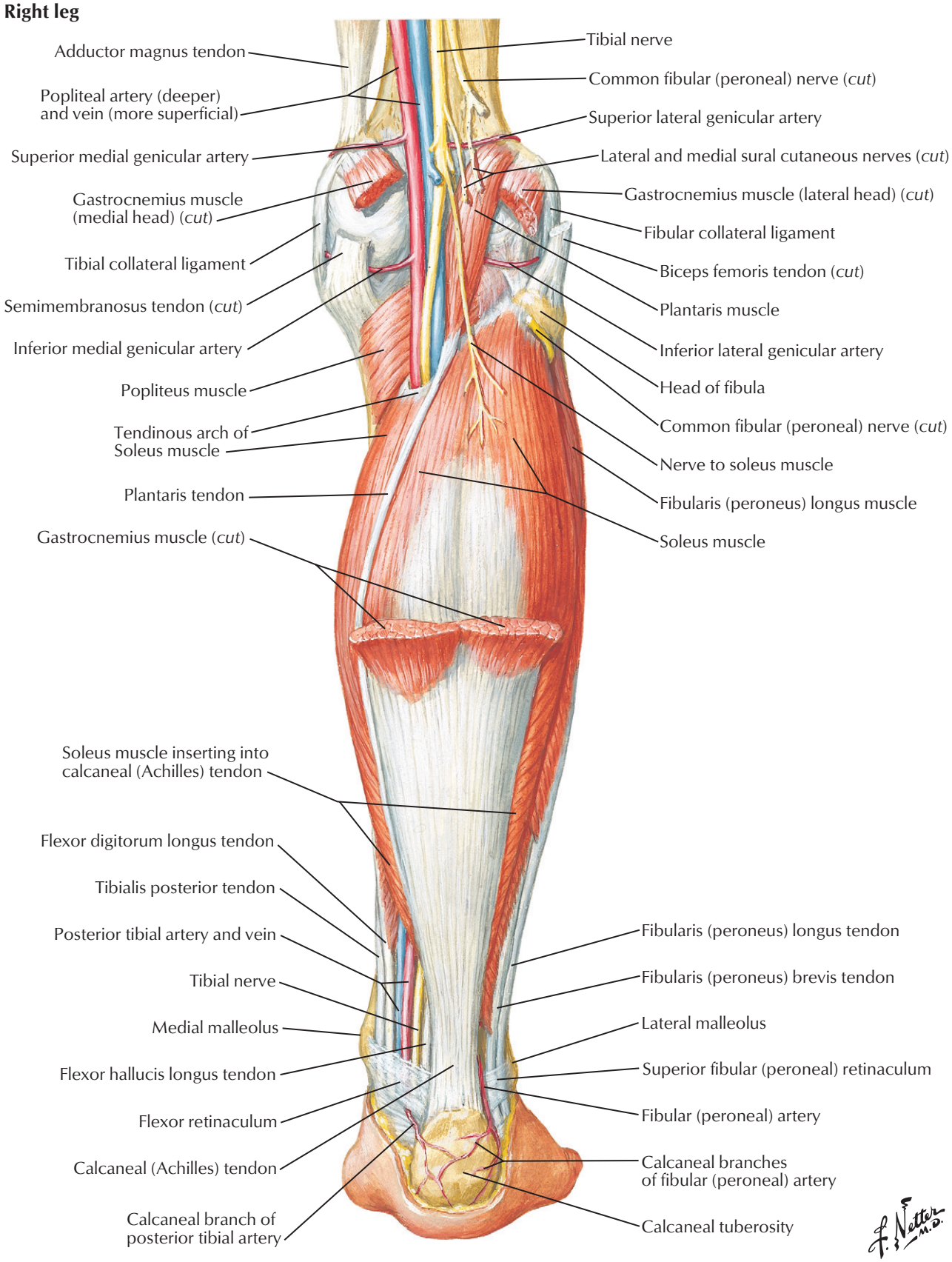
Right leg



Muscles of Leg (Intermediate Dissection): Posterior View

See also Plate 528

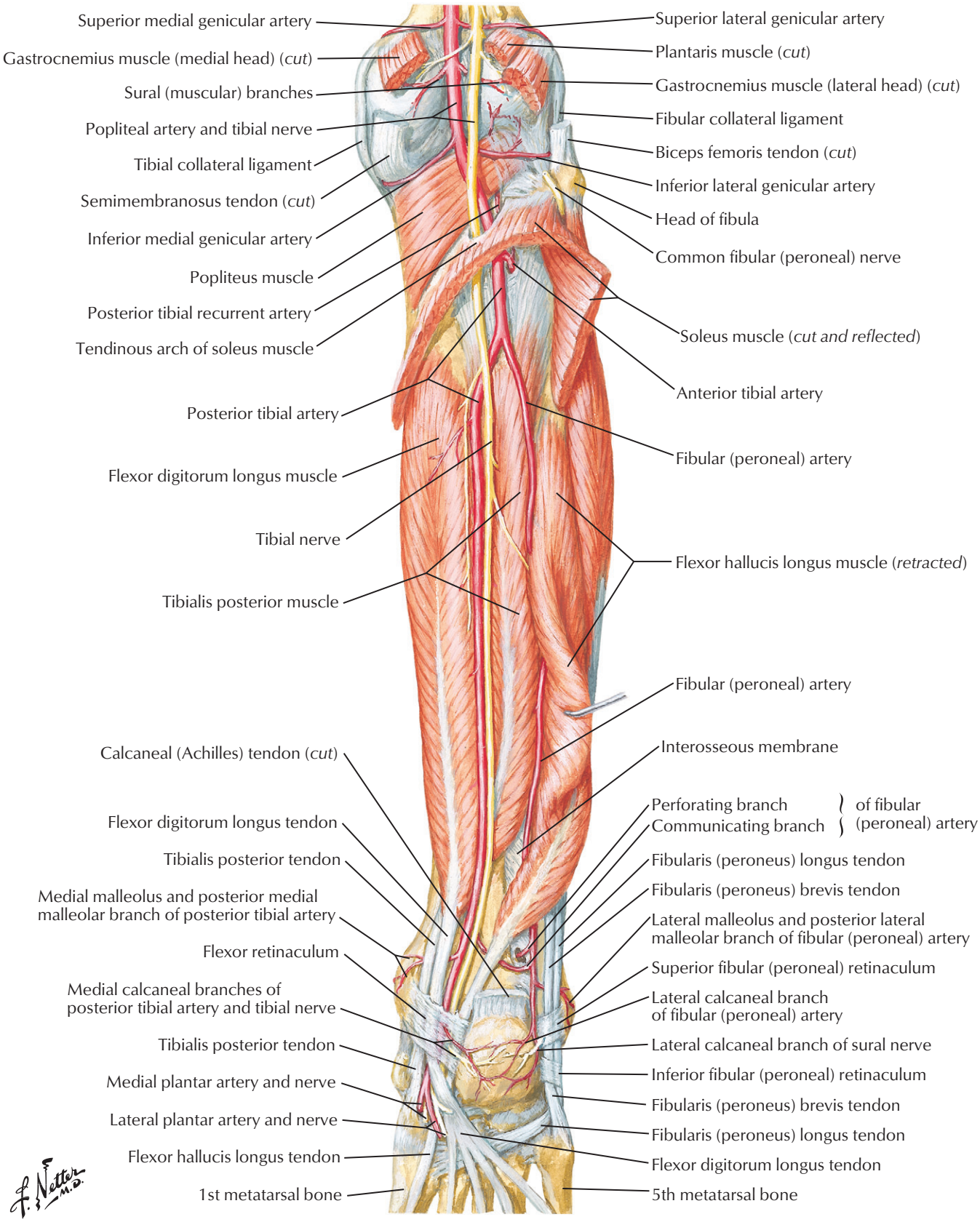
Right leg

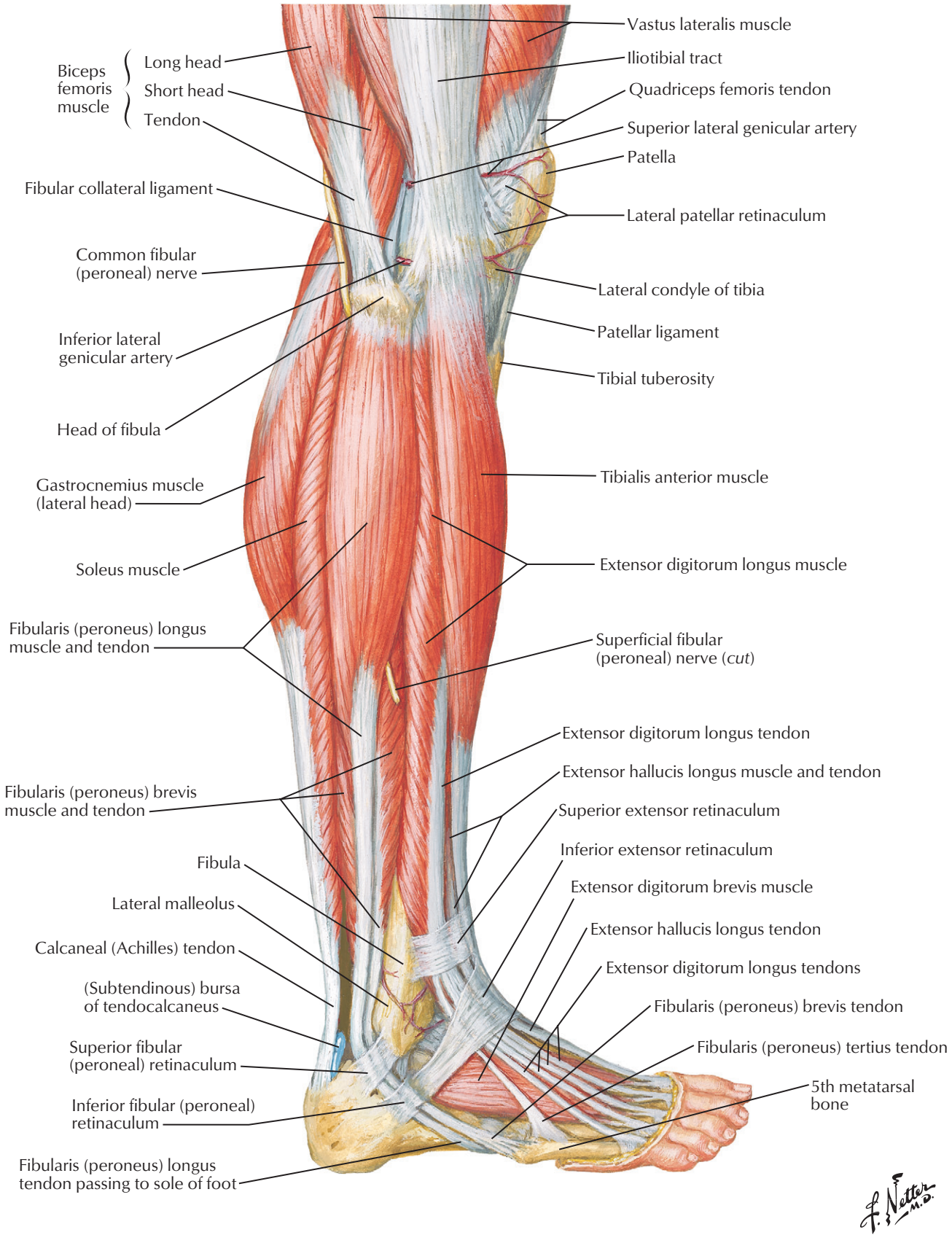


Muscles of Leg (Deep Dissection): Posterior View

See also Plate 528

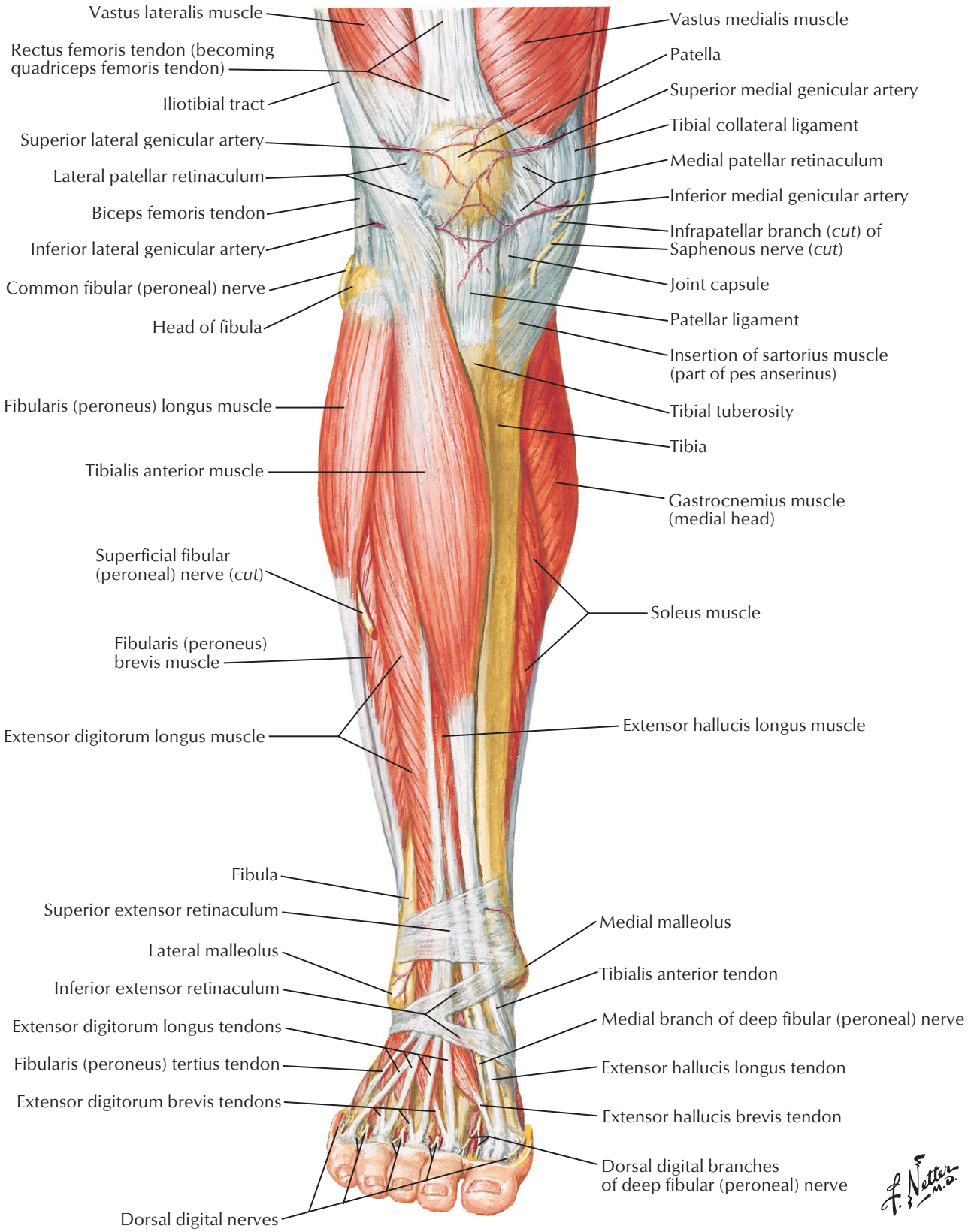
Right leg




Vastus lateralis muscle
Biceps femoris muscle
Long head
Short head
Tendon
Iliotibial tract
Quadriceps femoris tendon
Superior lateral genicular artery
Patella
Fibular collateral ligament
Lateral patellar retinaculum
Common fibular (peroneal) nerve
Lateral condyle of tibia
Inferior lateral genicular artery
Patellar ligament
Tibial tuberosity
Head of fibula
Tibialis anterior muscle
Gastrocnemius muscle (lateral head)
Soleus muscle
Extensor digitorum longus muscle
Fibularis (peroneus) longus muscle and tendon
Superficial fibular (peroneal) nerve (cut)
Extensor digitorum longus tendon
Extensor hallucis longus muscle and tendon
Fibularis (peroneus) brevis muscle and tendon
Superior extensor retinaculum
Inferior extensor retinaculum
Fibula
Extensor digitorum brevis muscle
Lateral malleolus
Extensor hallucis longus tendon
Calcaneal (Achilles) tendon
Extensor digitorum longus tendons
(Subtendinous) bursa of tendocalcaneus
Fibularis (peroneus) brevis tendon
Superior fibular (peroneal) retinaculum
Fibularis (peroneus) tertius tendon
Inferior fibular (peroneal) retinaculum
5th metatarsal bone
Fibularis (peroneus) longus tendon passing to sole of foot

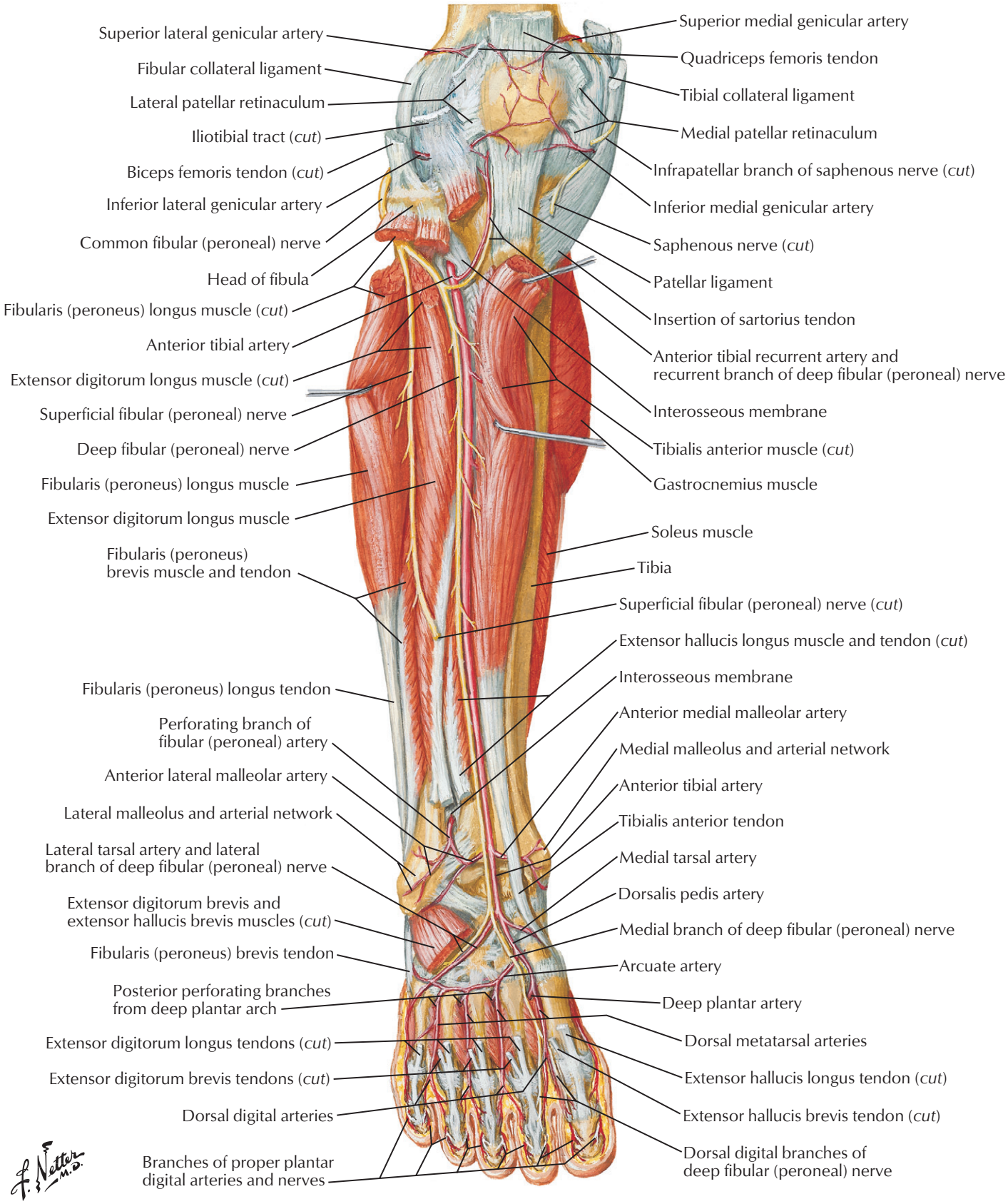
Muscles of Leg (Superficial Dissection): Anterior View

See also Plate 529



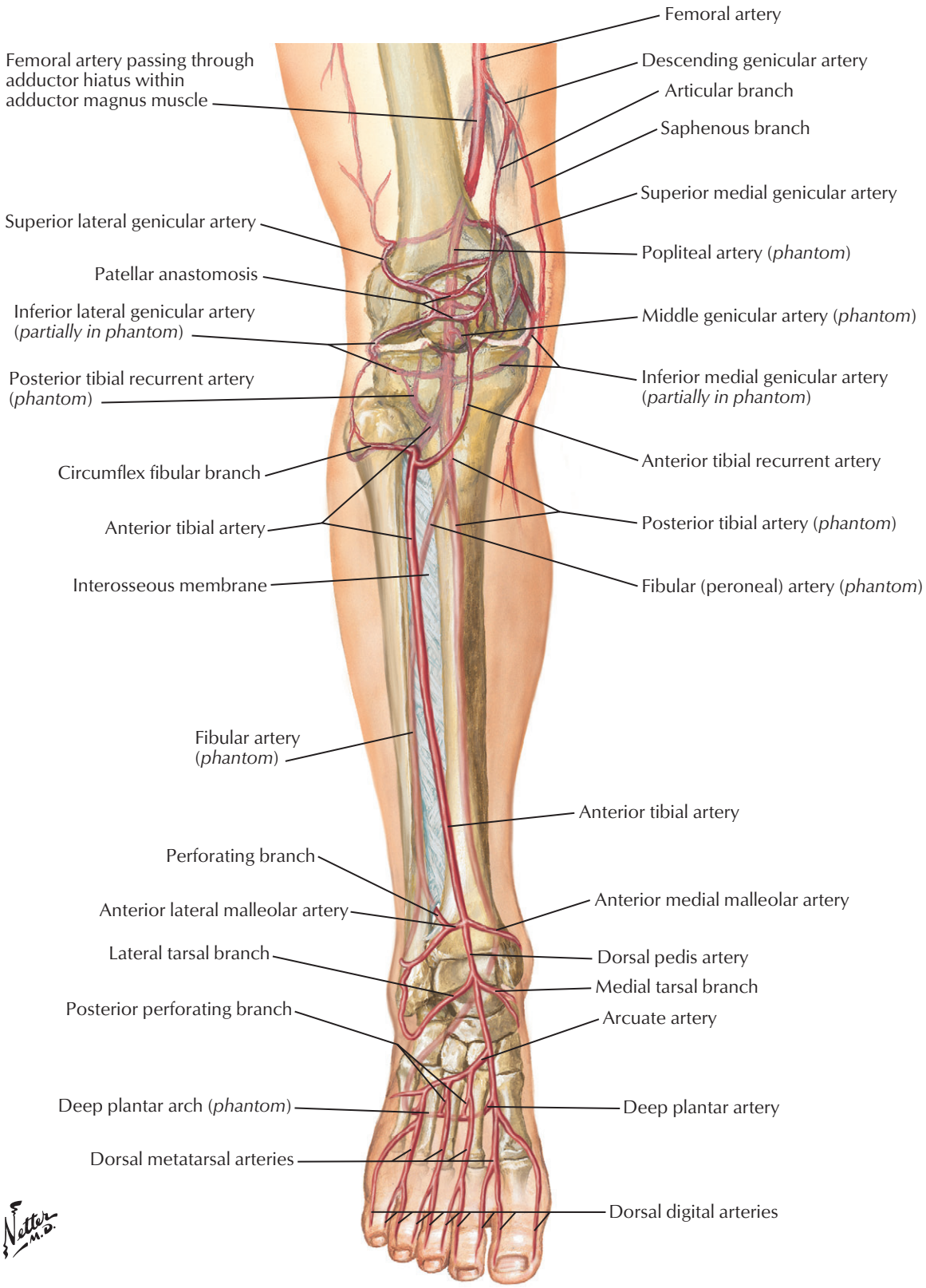
Muscles of Leg (Deep Dissection): Anterior View

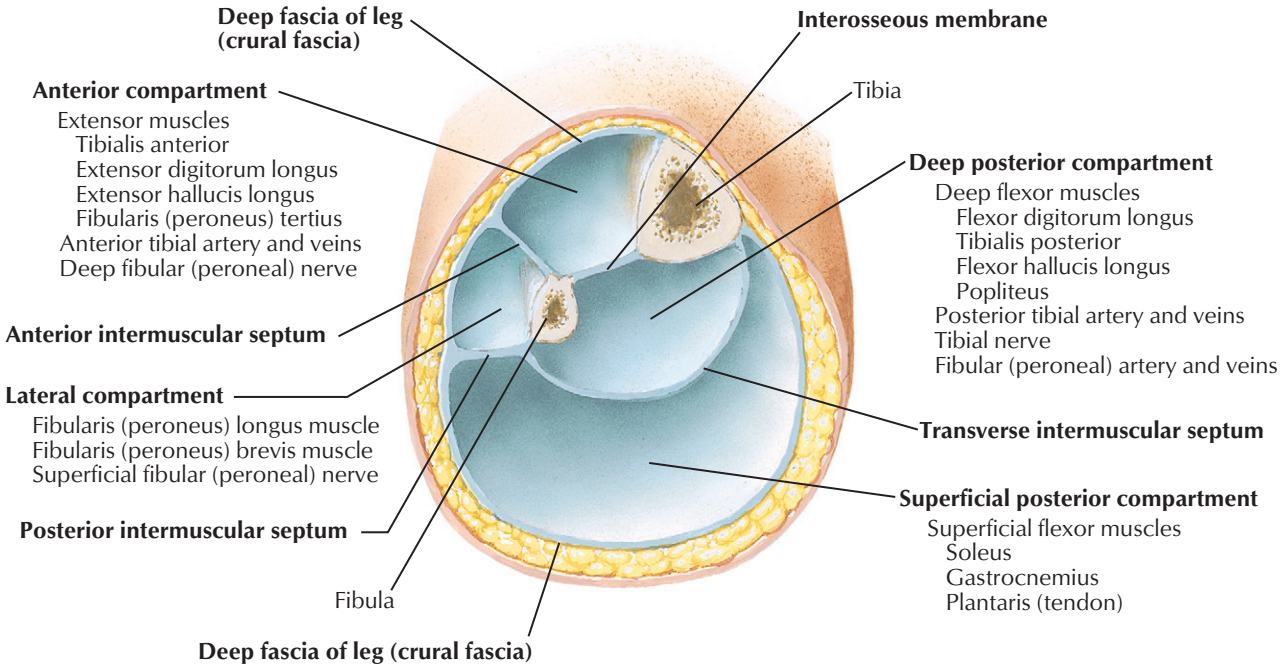
See also Plates 499, 523, 529



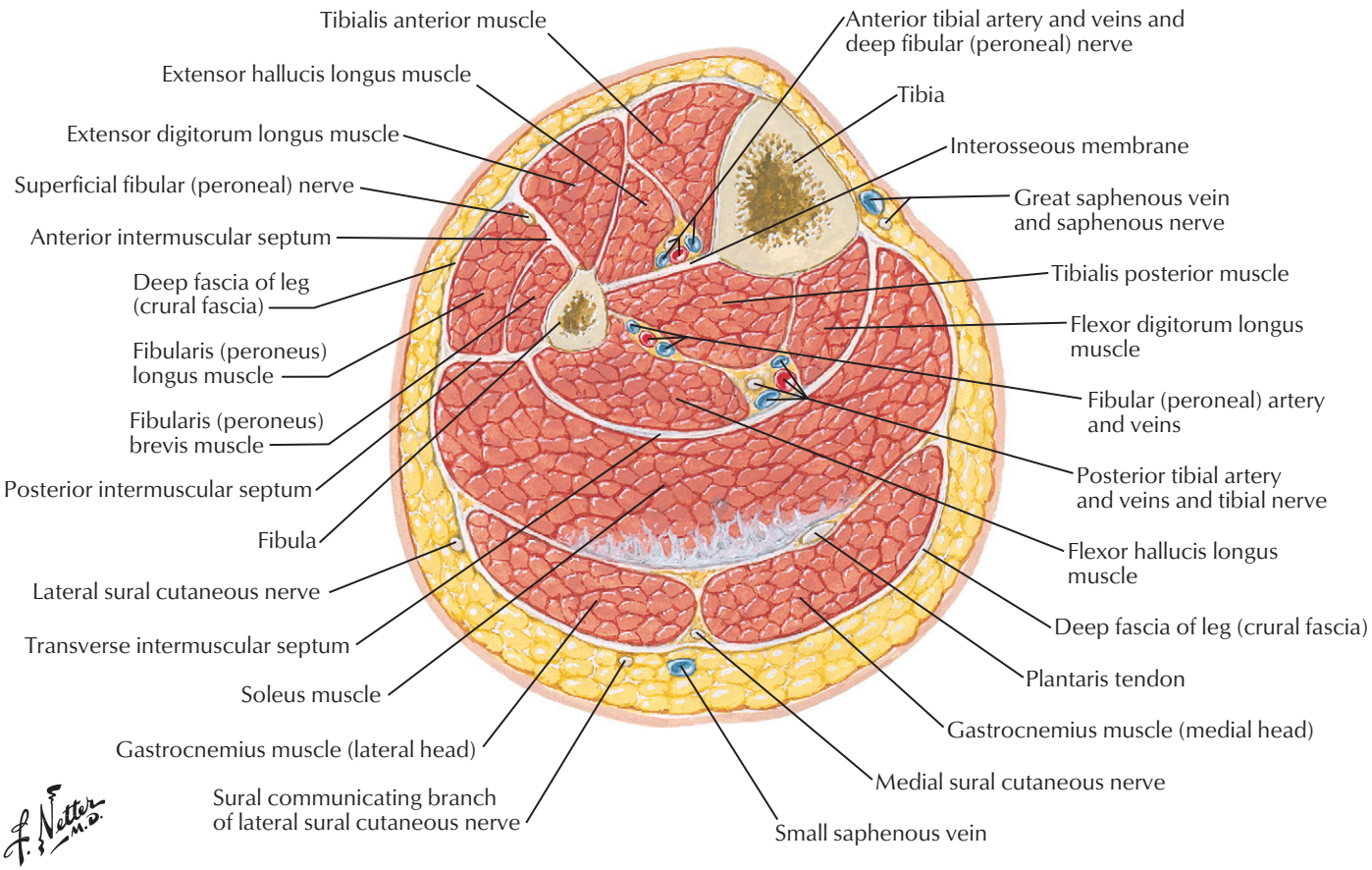
Arteries of Knee, Leg, and Foot

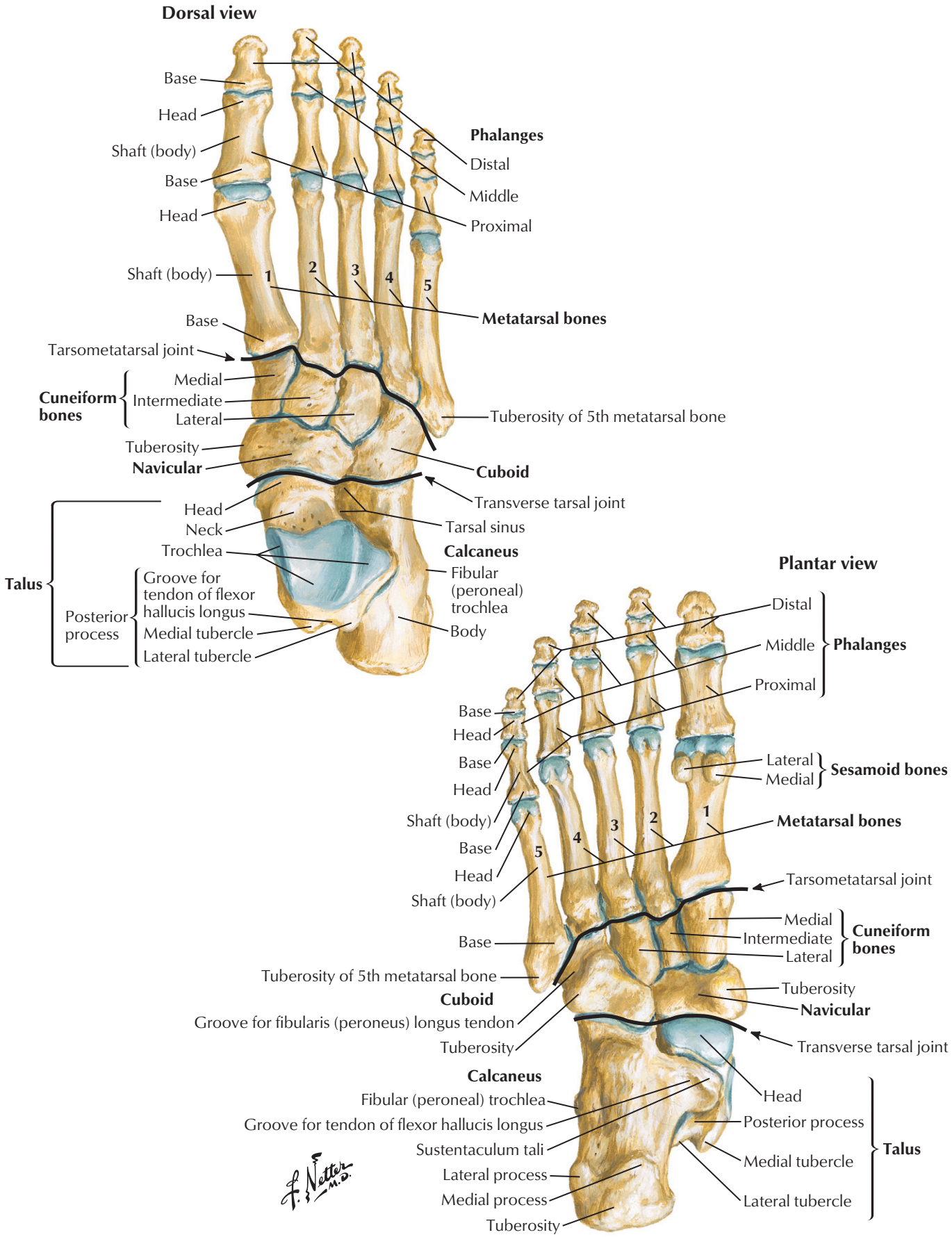
See also Plate 531

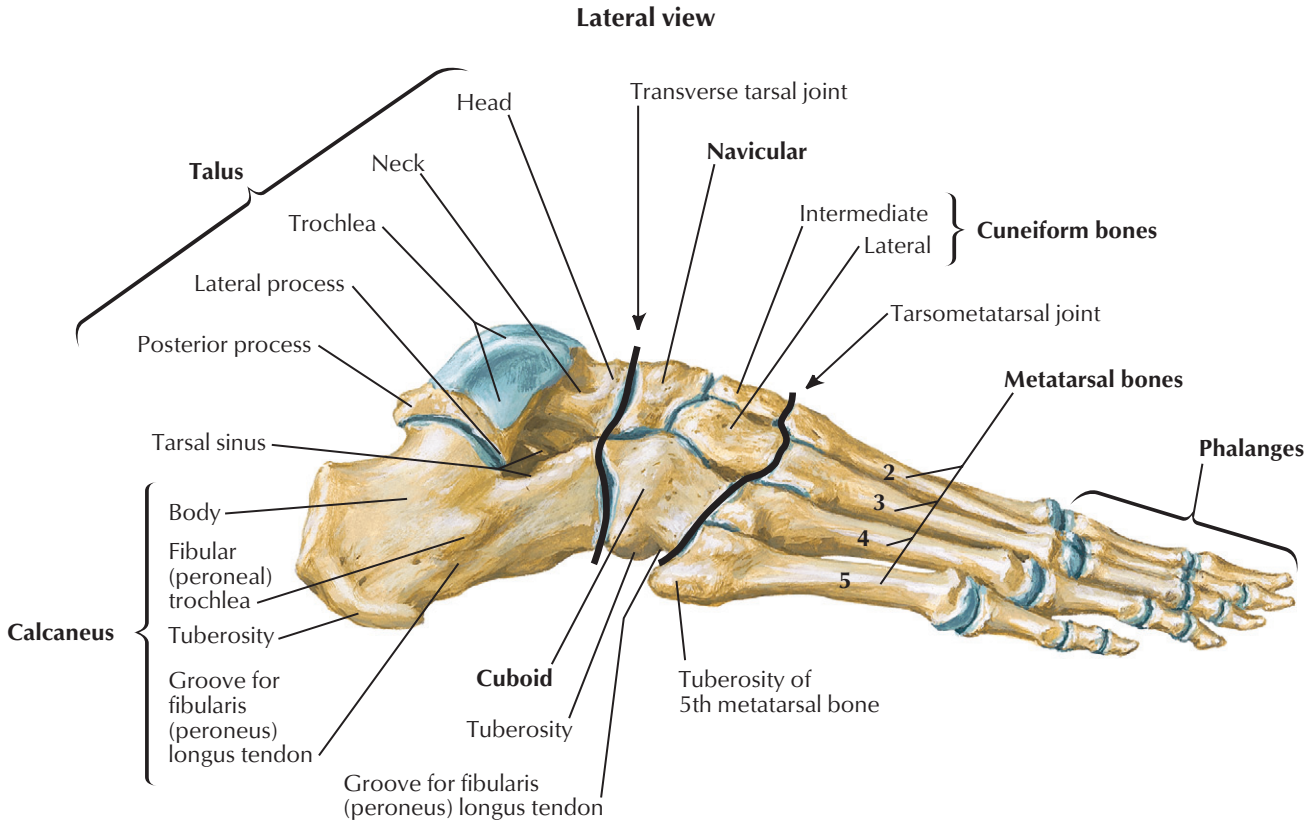


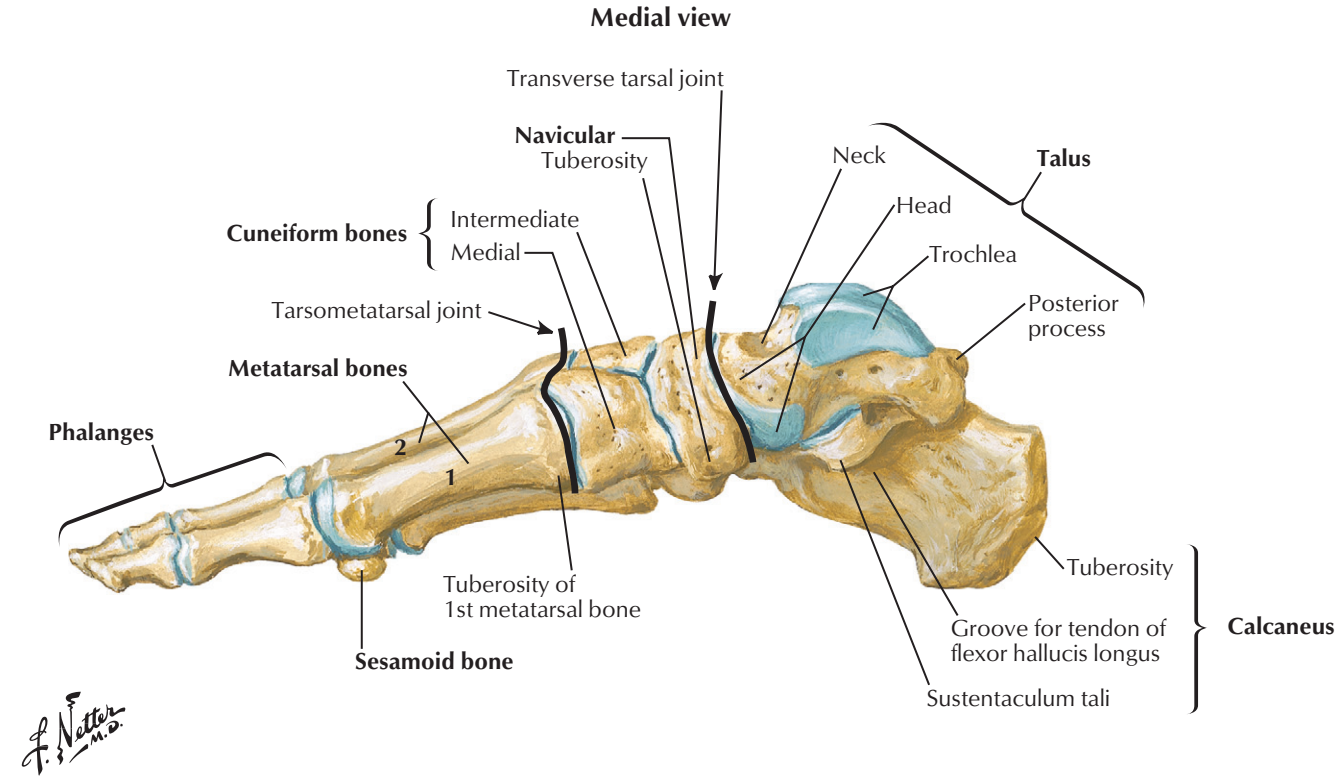


Cross section just above middle of leg

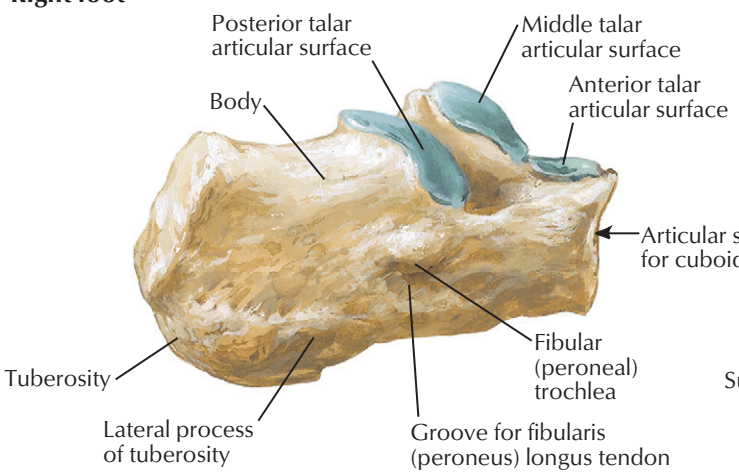



Dorsal view
Base
Head
Shaft (body)
Base
Head
Phalanges
Distal
Middle
Proximal
Shaft (body)
1
2
3
4
5
Metatarsal bones
Base
Tarsometatarsal joint
Cuneiform bones
Medial
Intermediate
Lateral
Tuberosity of 5th metatarsal bone
Tuberosity
Navicular
Cuboid
Transverse tarsal joint
Talus
Head
Neck
Trochlea
Tarsal sinus
Calcaneus
Fibular (peroneal) trochlea
Posterior process
Groove for tendon of flexor hallucis longus
Medial tubercle
Lateral tubercle
Body
Plantar view
Distal
Middle
Proximal
Phalanges
Base
Head
Base
Head
Lateral
Medial
Sesamoid bones
Shaft (body)
Base
Head
Shaft (body)
1
2
3
4
5
Metatarsal bones
Tarsometatarsal joint
Medial
Intermediate
Lateral
Cuneiform bones
Base
Tuberosity of 5th metatarsal bone
Cuboid
Groove for fibularis (peroneus) longus tendon
Tuberosity
Tuberosity
Navicular
Transverse tarsal joint
Calcaneus
Fibular (peroneal) trochlea
Groove for tendon of flexor hallucis longus
Sustentaculum tali
Lateral process
Medial process
Tuberosity
Head
Posterior process
Medial tubercle
Lateral tubercle
Talus

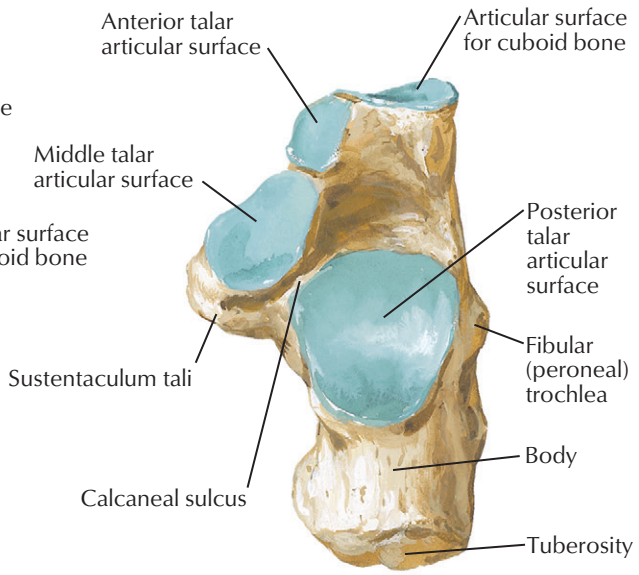

Lateral view
Talus
Head
Neck
Trochlea
Lateral process
Posterior process
Transverse tarsal joint
Navicular
Intermediate
Lateral
Cuneiform bones
Tarsometatarsal joint
Metatarsal bones
Phalanges
Tarsal sinus
Body
Fibular (peroneal) trochlea
Tuberosity
Groove for fibularis (peroneus) longus tendon
Calcaneus
Cuboid
Tuberosity
Groove for fibularis (peroneus) longus tendon
Tuberosity of 5th metatarsal bone
2
3
4
5


Medial view
Transverse tarsal joint
Navicular
Tuberosity
Cuneiform bones
Intermediate
Medial
Tarsometatarsal joint
Metatarsal bones
Phalanges
2
1
Tuberosity of 1st metatarsal bone
Sesamoid bone
Neck
Talus
Head
Trochlea
Posterior process
Tuberosity
Groove for tendon of flexor hallucis longus
Sustentaculum tali
Calcaneus

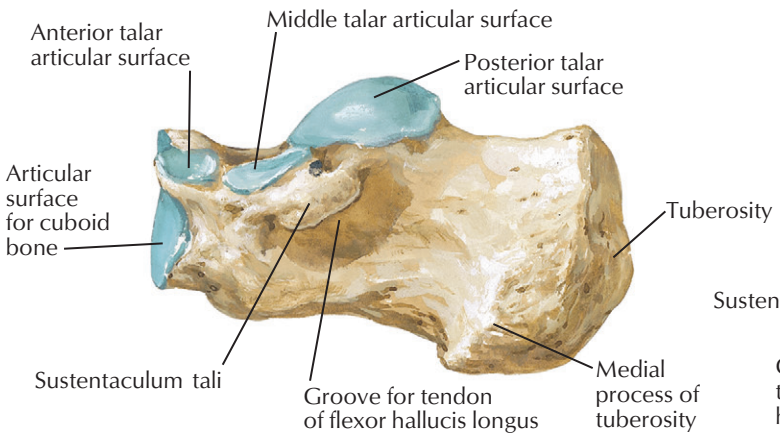
Right foot



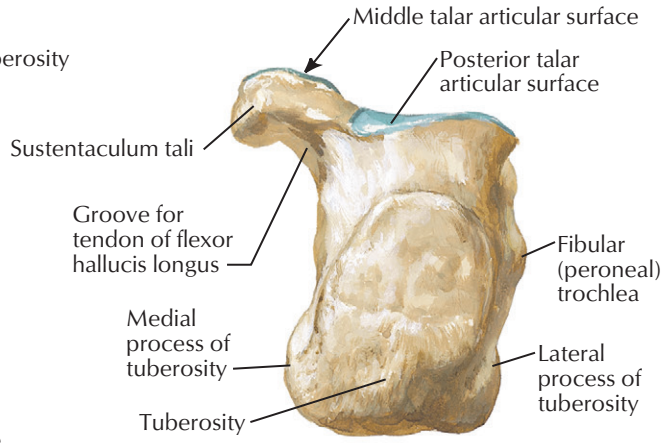
Lateral view



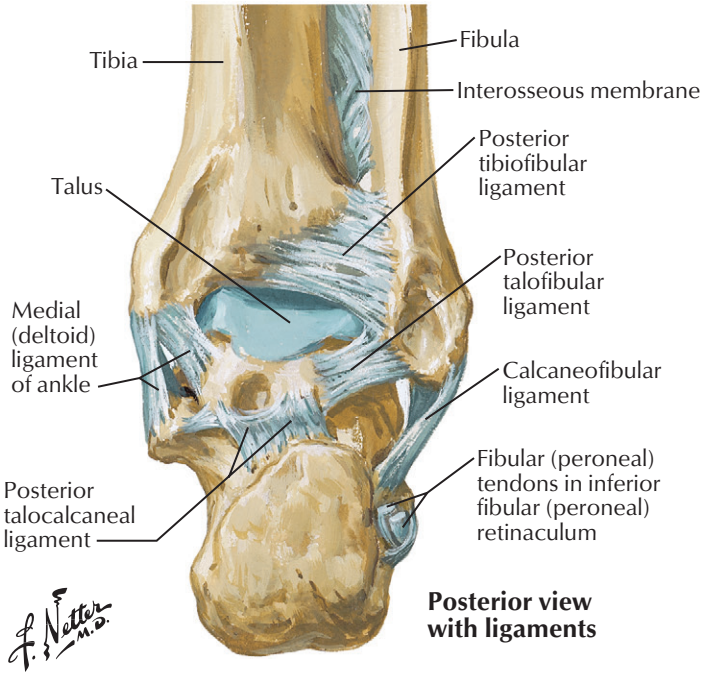
Superior view



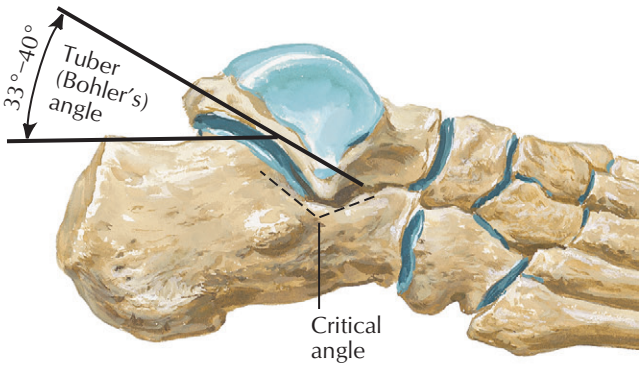
Medial view



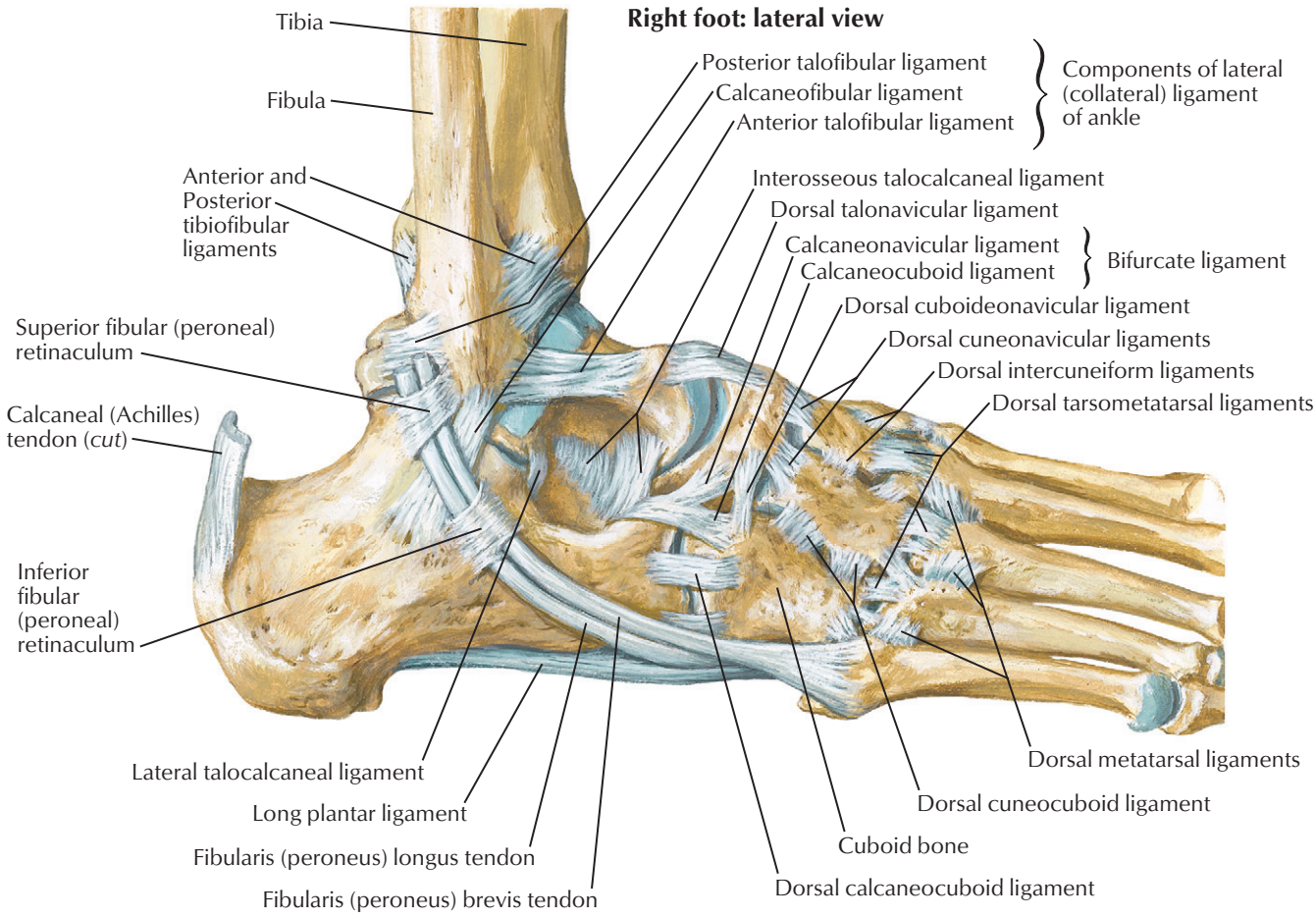
Posterior view

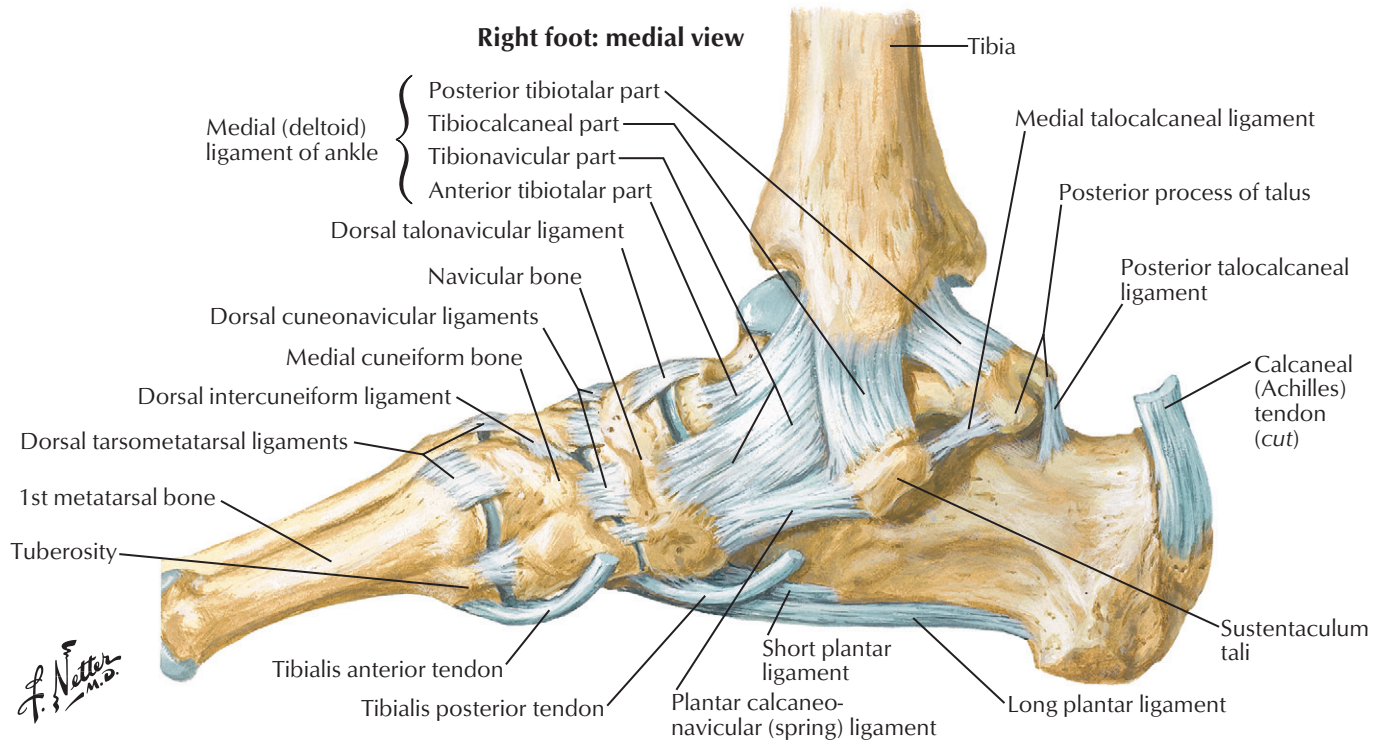


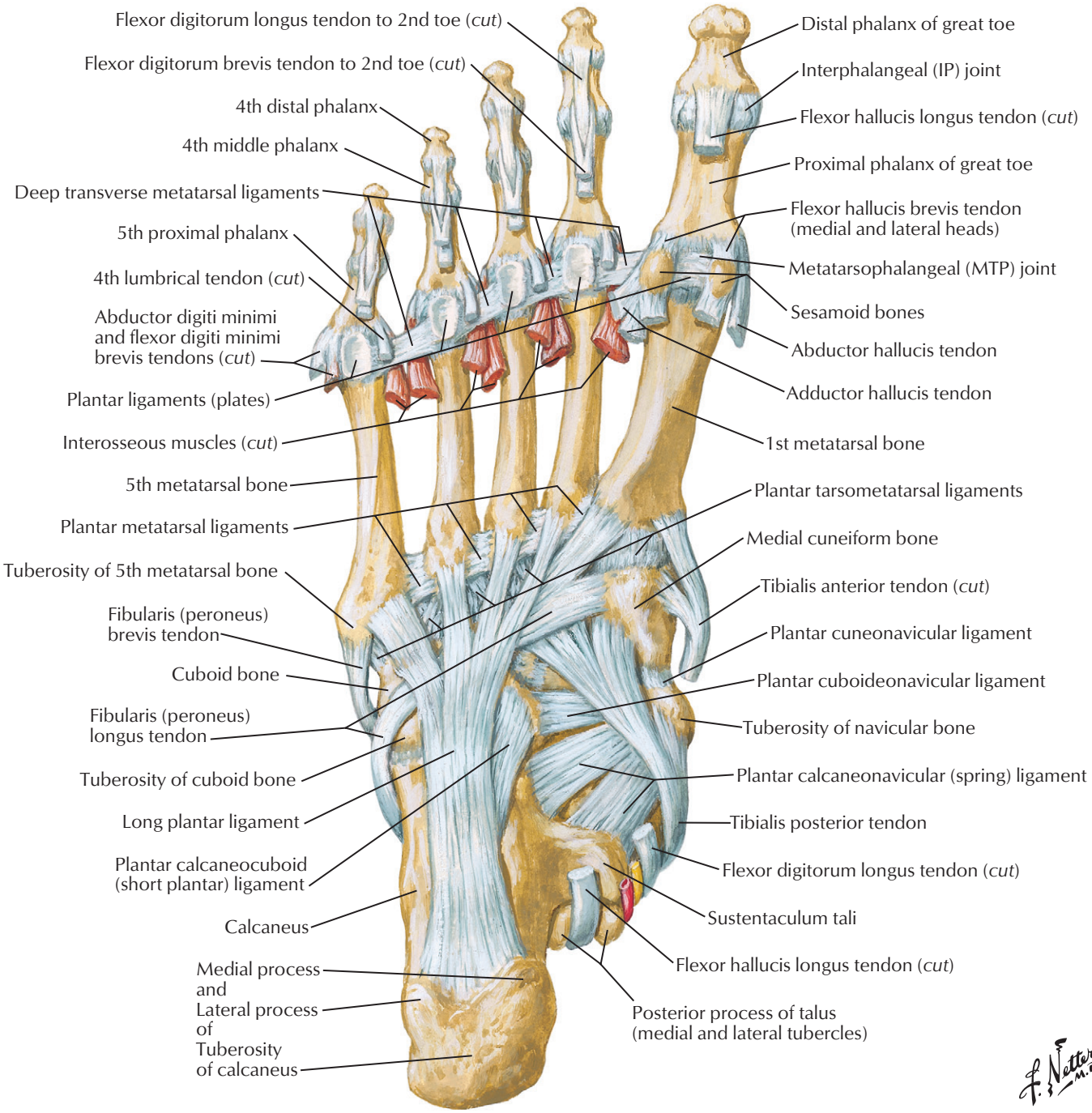
Posterior view with ligaments

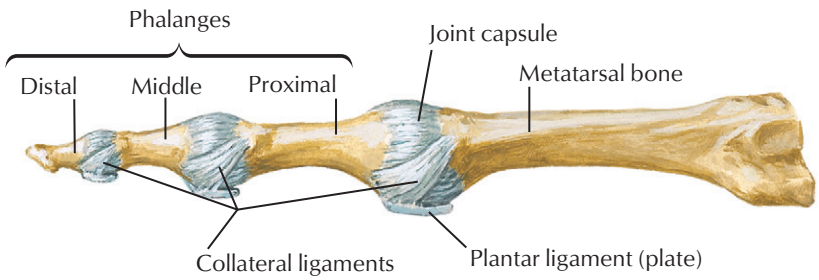


Functional relations of calcaneus

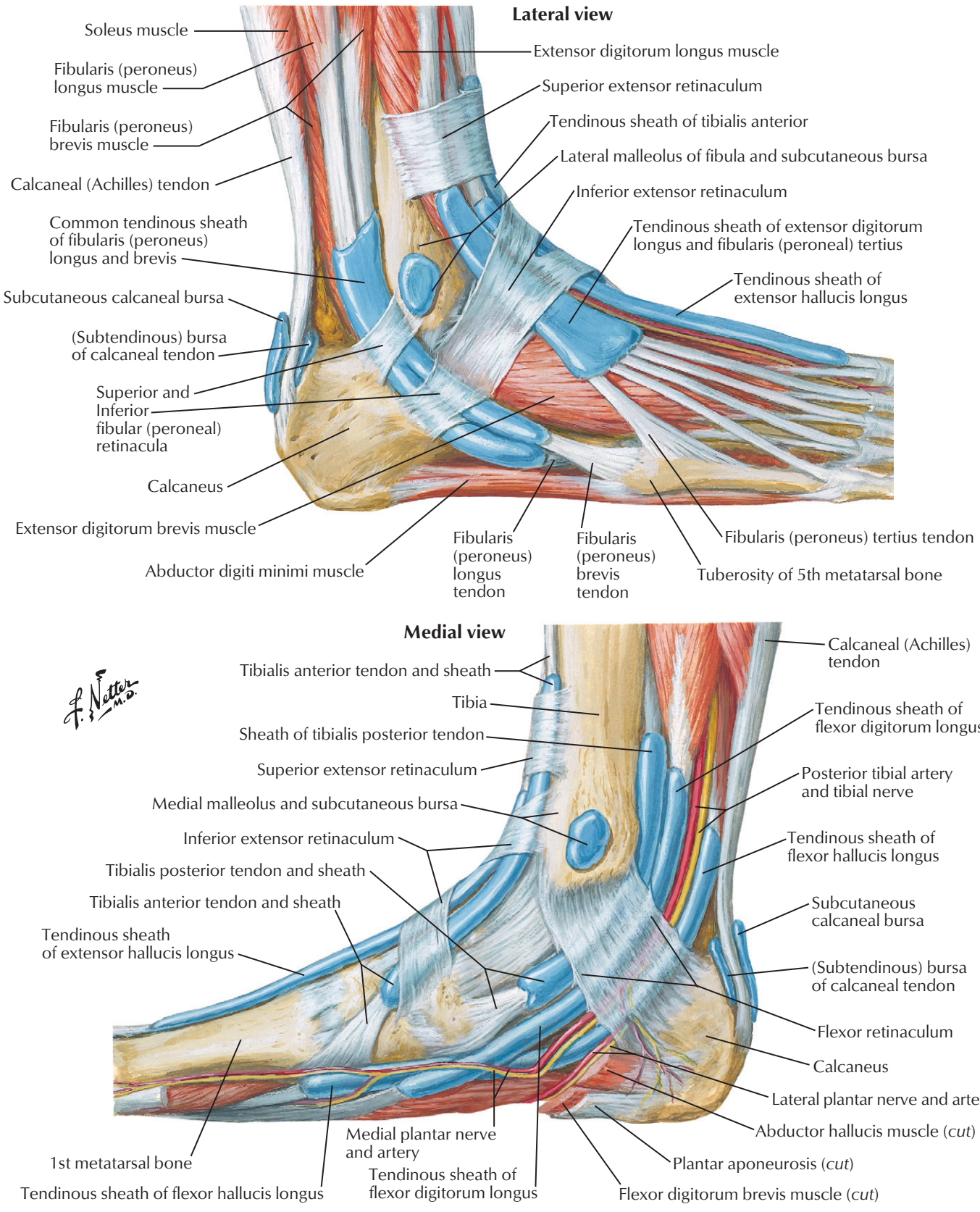

Right foot: lateral view
Tibia
Fibula
Anterior and Posterior tibiofibular ligaments
Superior fibular (peroneal) retinaculum
Calcaneal (Achilles) tendon (cut)
Inferior fibular (peroneal) retinaculum
Lateral talocalcaneal ligament
Long plantar ligament
Fibularis (peroneus) longus tendon
Fibularis (peroneus) brevis tendon
Posterior talofibular ligament
Calcaneofibular ligament
Anterior talofibular ligament
Components of lateral (collateral) ligament of ankle
Interosseous talocalcaneal ligament
Dorsal talonavicular ligament
Calcaneonavicular ligament
Calcaneocuboid ligament
Bifurcate ligament
Dorsal cuboideonavicular ligament
Dorsal cuneonavicular ligaments
Dorsal intercuneiform ligaments
Dorsal tarsometatarsal ligaments
Dorsal metatarsal ligaments
Dorsal cuneocuboid ligament
Cuboid bone
Dorsal calcaneocuboid ligament


Right foot: medial view
Tibia
Medial (deltoid) ligament of ankle
Posterior tibiotalar part
Tibiocalcaneal part
Tibionavicular part
Anterior tibiotalar part
Medial talocalcaneal ligament
Posterior process of talus
Dorsal talonavicular ligament
Navicular bone
Posterior talocalcaneal ligament
Dorsal cuneonavicular ligaments
Medial cuneiform bone
Dorsal intercuneiform ligament
Calcaneal (Achilles) tendon (cut)
Dorsal tarsometatarsal ligaments
1st metatarsal bone
Tuberosity
Sustentaculum tali
Short plantar ligament
Tibialis anterior tendon
Tibialis posterior tendon
Plantar calcaneo-navicular (spring) ligament
Long plantar ligament



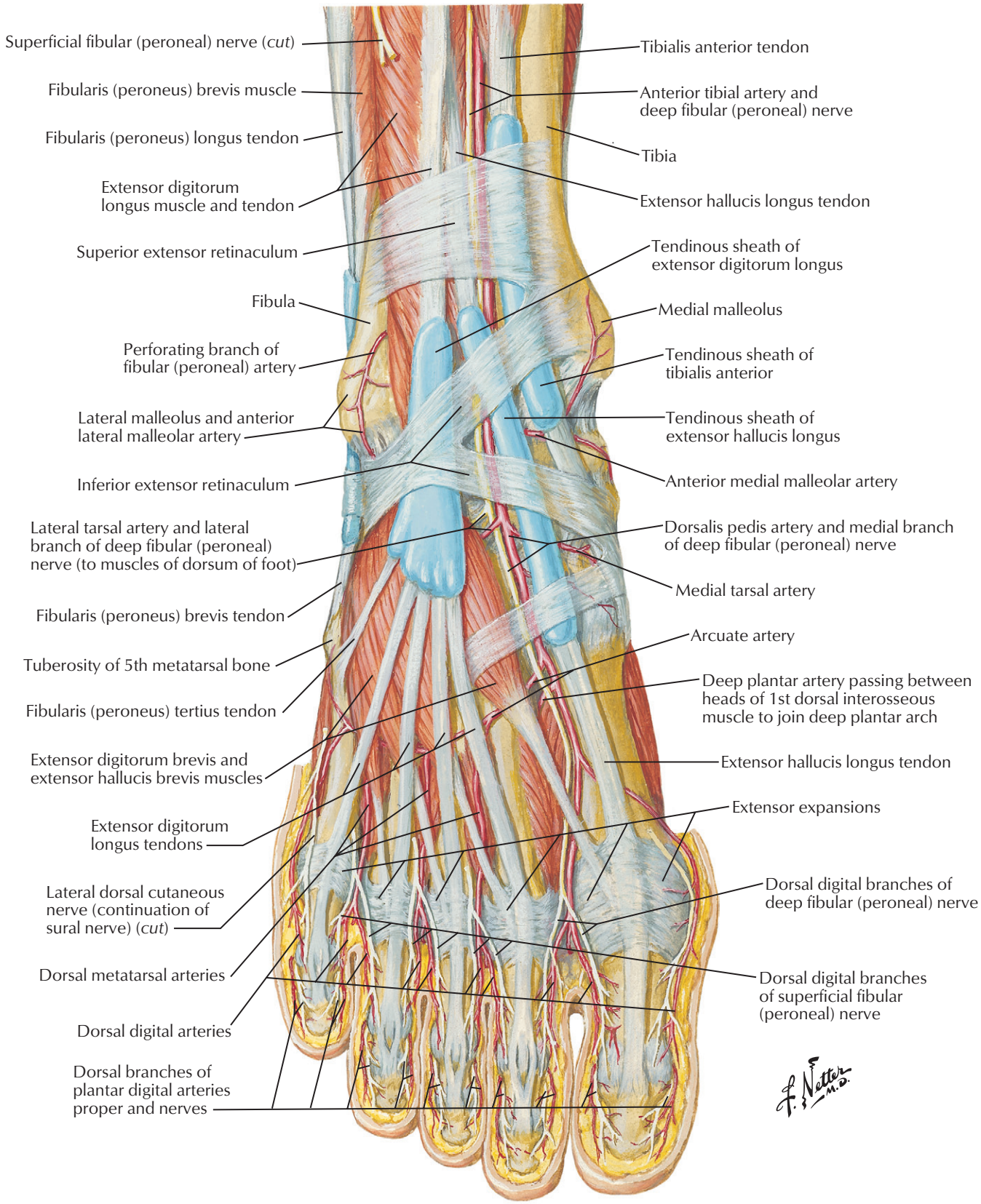


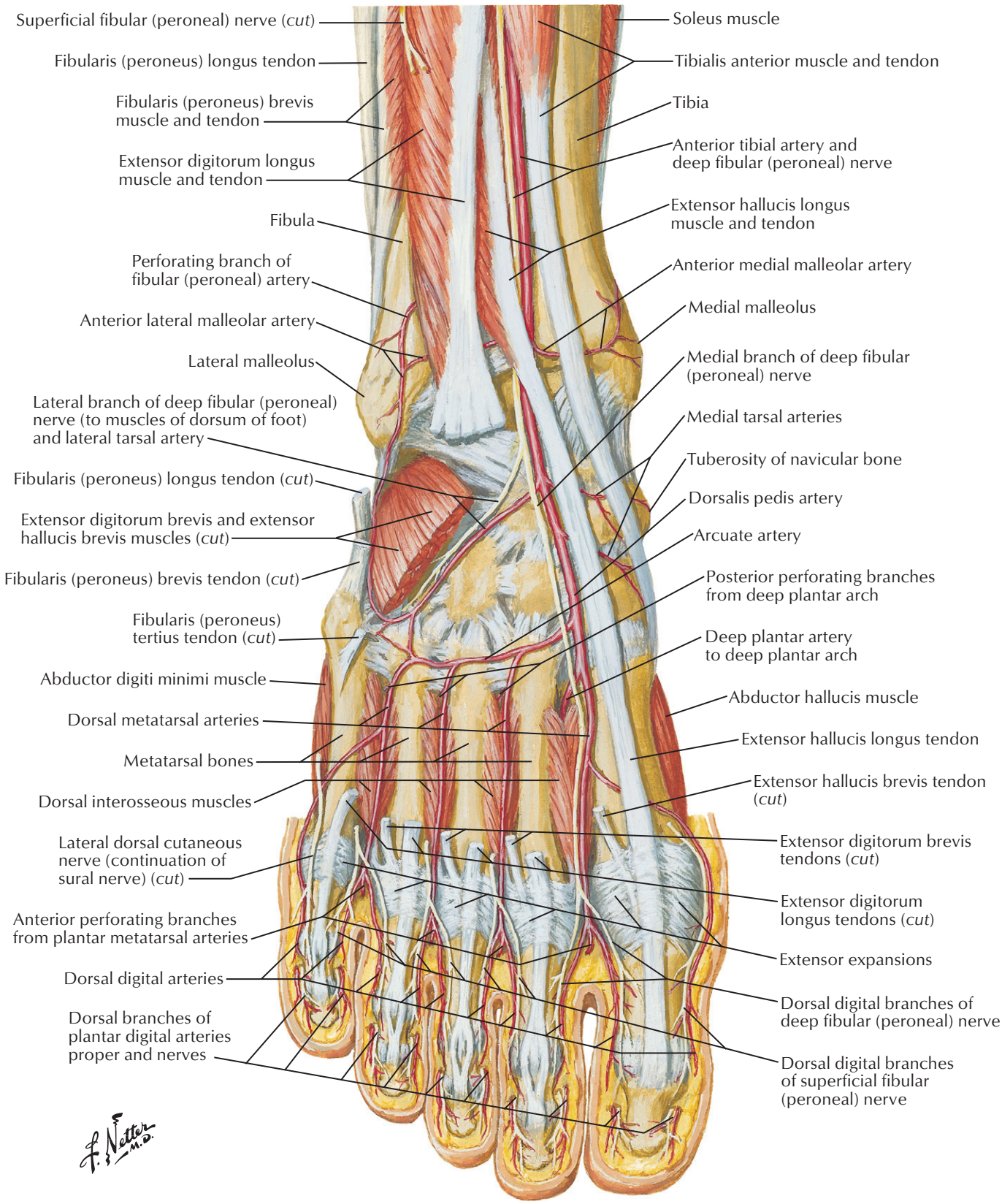
Capsules and ligaments of metatarsophalangeal and interphalangeal joints: lateral view

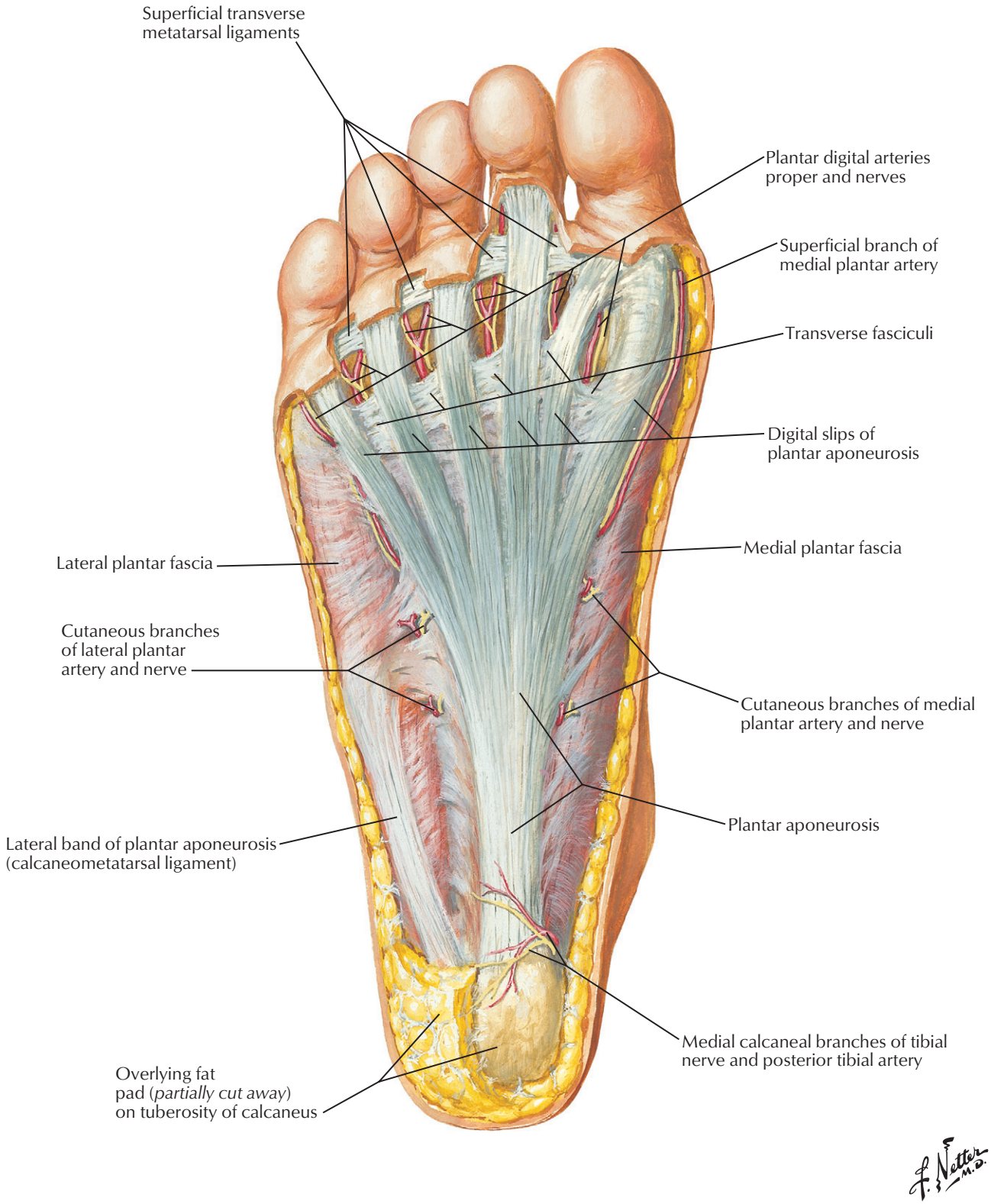

Lateral view
Soleus muscle
Fibularis (peroneus) longus muscle
Fibularis (peroneus) brevis muscle
Calcaneal (Achilles) tendon
Common tendinous sheath of fibularis (peroneus) longus and brevis
Subcutaneous calcaneal bursa
(Subtendinous) bursa of calcaneal tendon
Superior and Inferior fibular (peroneal) retinacula
Calcaneus
Extensor digitorum brevis muscle
Abductor digiti minimi muscle
Extensor digitorum longus muscle
Superior extensor retinaculum
Tendinous sheath of tibialis anterior
Lateral malleolus of fibula and subcutaneous bursa
Inferior extensor retinaculum
Tendinous sheath of extensor digitorum longus and fibularis (peroneal) tertius
Tendinous sheath of extensor hallucis longus
Fibularis (peroneus) longus tendon
Fibularis (peroneus) brevis tendon
Fibularis (peroneus) tertius tendon
Tuberosity of 5th metatarsal bone
Medial view
Tibialis anterior tendon and sheath
Tibia
Sheath of tibialis posterior tendon
Superior extensor retinaculum
Medial malleolus and subcutaneous bursa
Inferior extensor retinaculum
Tibialis posterior tendon and sheath
Tibialis anterior tendon and sheath
Tendinous sheath of extensor hallucis longus
1st metatarsal bone
Tendinous sheath of flexor hallucis longus
Medial plantar nerve and artery
Tendinous sheath of flexor digitorum longus
Calcaneal (Achilles) tendon
Tendinous sheath of flexor digitorum longus
Posterior tibial artery and tibial nerve
Tendinous sheath of flexor hallucis longus
Subcutaneous calcaneal bursa
(Subtendinous) bursa of calcaneal tendon
Flexor retinaculum
Calcaneus
Lateral plantar nerve and artery
Abductor hallucis muscle (cut)
Plantar aponeurosis (cut)
Flexor digitorum brevis muscle (cut)

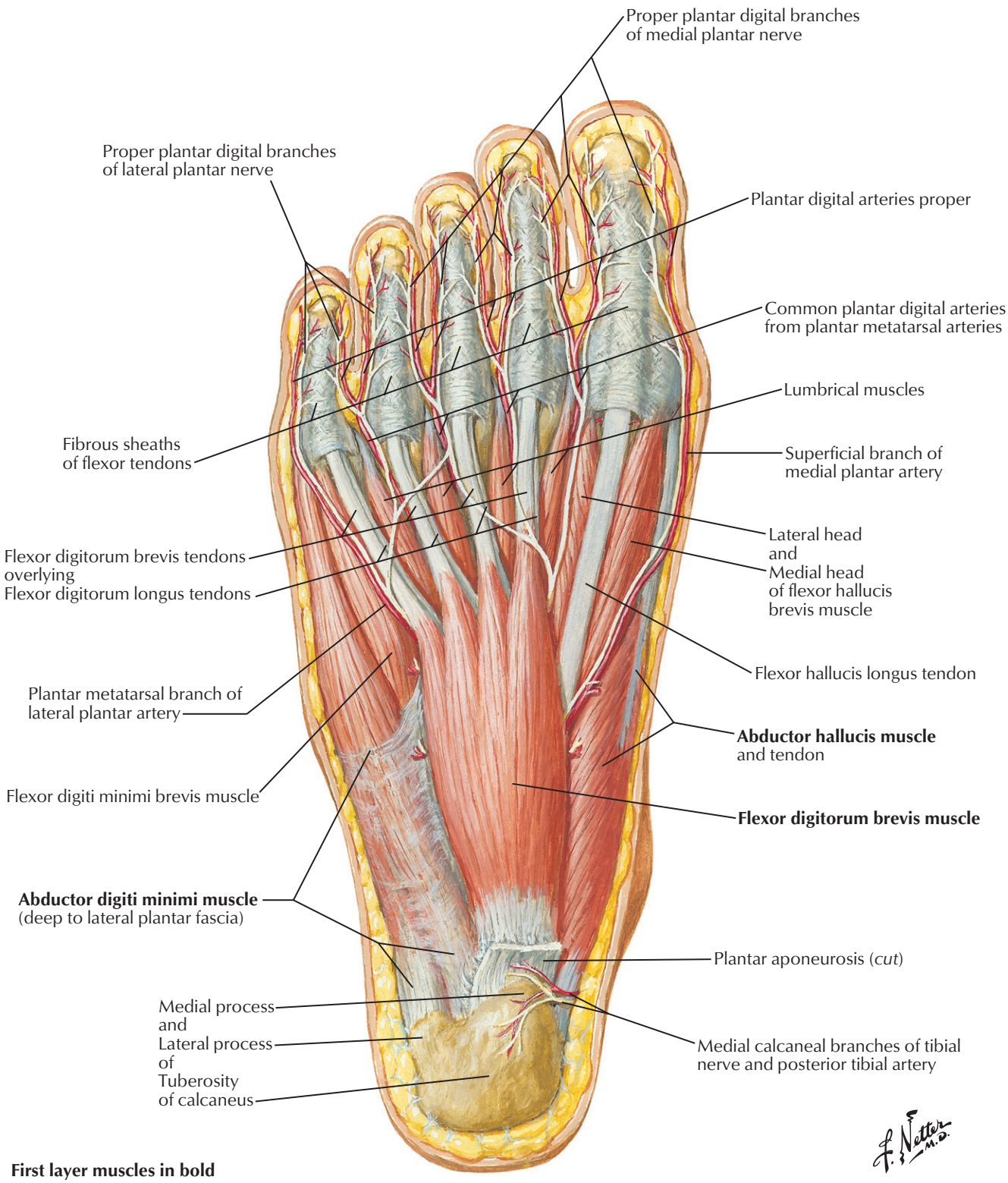
Muscles of Dorsum of Foot: Superficial Dissection

See also Plate 529




Superficial fibular (peroneal) nerve (*cut*)
Fibularis (peroneus) longus tendon
Fibularis (peroneus) brevis muscle and tendon
Extensor digitorum longus muscle and tendon
Fibula
Perforating branch of fibular (peroneal) artery
Anterior lateral malleolar artery
Lateral malleolus
Lateral branch of deep fibular (peroneal) nerve (to muscles of dorsum of foot) and lateral tarsal artery
Fibularis (peroneus) longus tendon (*cut*)
Extensor digitorum brevis and extensor hallucis brevis muscles (*cut*)
Fibularis (peroneus) brevis tendon (*cut*)
Fibularis (peroneus) tertius tendon (*cut*)
Abductor digiti minimi muscle
Dorsal metatarsal arteries
Metatarsal bones
Dorsal interosseous muscles
Lateral dorsal cutaneous nerve (continuation of sural nerve) (*cut*)
Anterior perforating branches from plantar metatarsal arteries
Dorsal digital arteries
Dorsal branches of plantar digital arteries proper and nerves
Soleus muscle
Tibialis anterior muscle and tendon
Tibia
Anterior tibial artery and deep fibular (peroneal) nerve
Extensor hallucis longus muscle and tendon
Anterior medial malleolar artery
Medial malleolus
Medial branch of deep fibular (peroneal) nerve
Medial tarsal arteries
Tuberosity of navicular bone
Dorsalis pedis artery
Arcuate artery
Posterior perforating branches from deep plantar arch
Deep plantar artery to deep plantar arch
Abductor hallucis muscle
Extensor hallucis longus tendon
Extensor hallucis brevis tendon (*cut*)
Extensor digitorum brevis tendons (*cut*)
Extensor digitorum longus tendons (*cut*)
Extensor expansions
Dorsal digital branches of deep fibular (peroneal) nerve
Dorsal digital branches of superficial fibular (peroneal) nerve

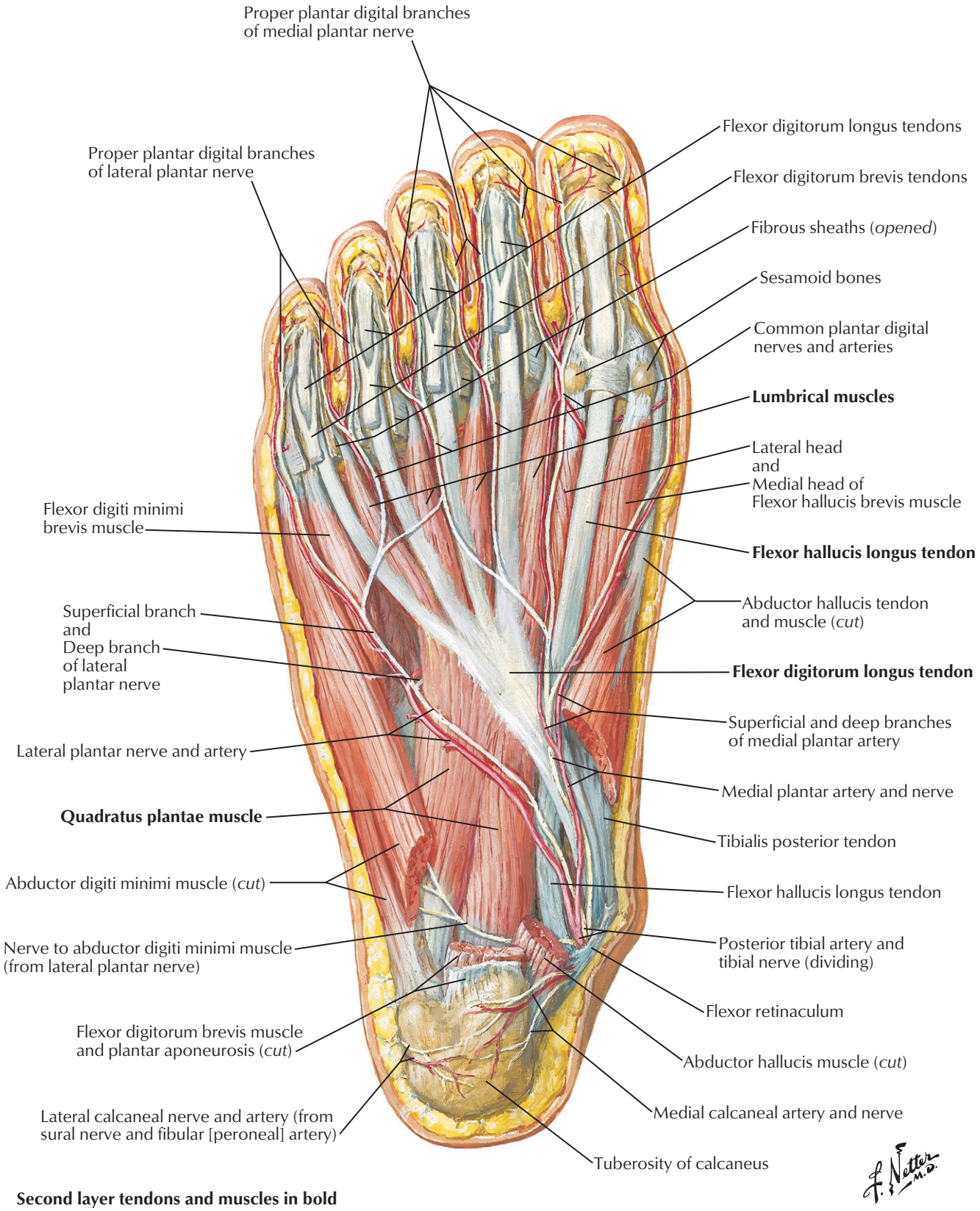

Superficial transverse metatarsal ligaments
Plantar digital arteries proper and nerves
Superficial branch of medial plantar artery
Transverse fasciculi
Digital slips of plantar aponeurosis
Lateral plantar fascia
Medial plantar fascia
Cutaneous branches of lateral plantar artery and nerve
Cutaneous branches of medial plantar artery and nerve
Plantar aponeurosis
Lateral band of plantar aponeurosis (calcaneometatarsal ligament)
Medial calcaneal branches of tibial nerve and posterior tibial artery
Overlying fat pad (*partially cut away*) on tuberosity of calcaneus



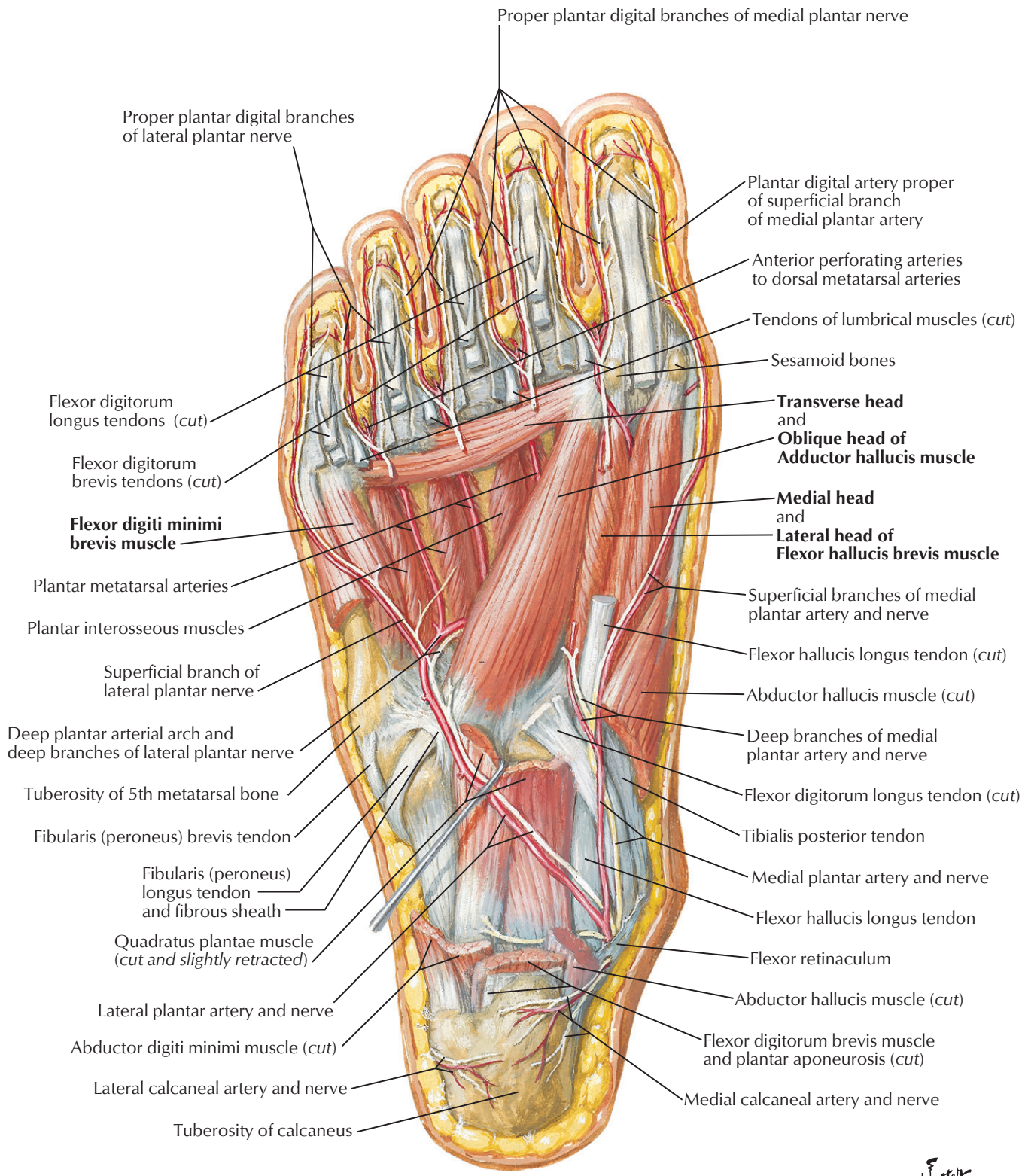
First layer muscles in bold

Muscles of Sole of Foot: Second Layer

See also Plate 528



Second layer tendons and muscles in bold

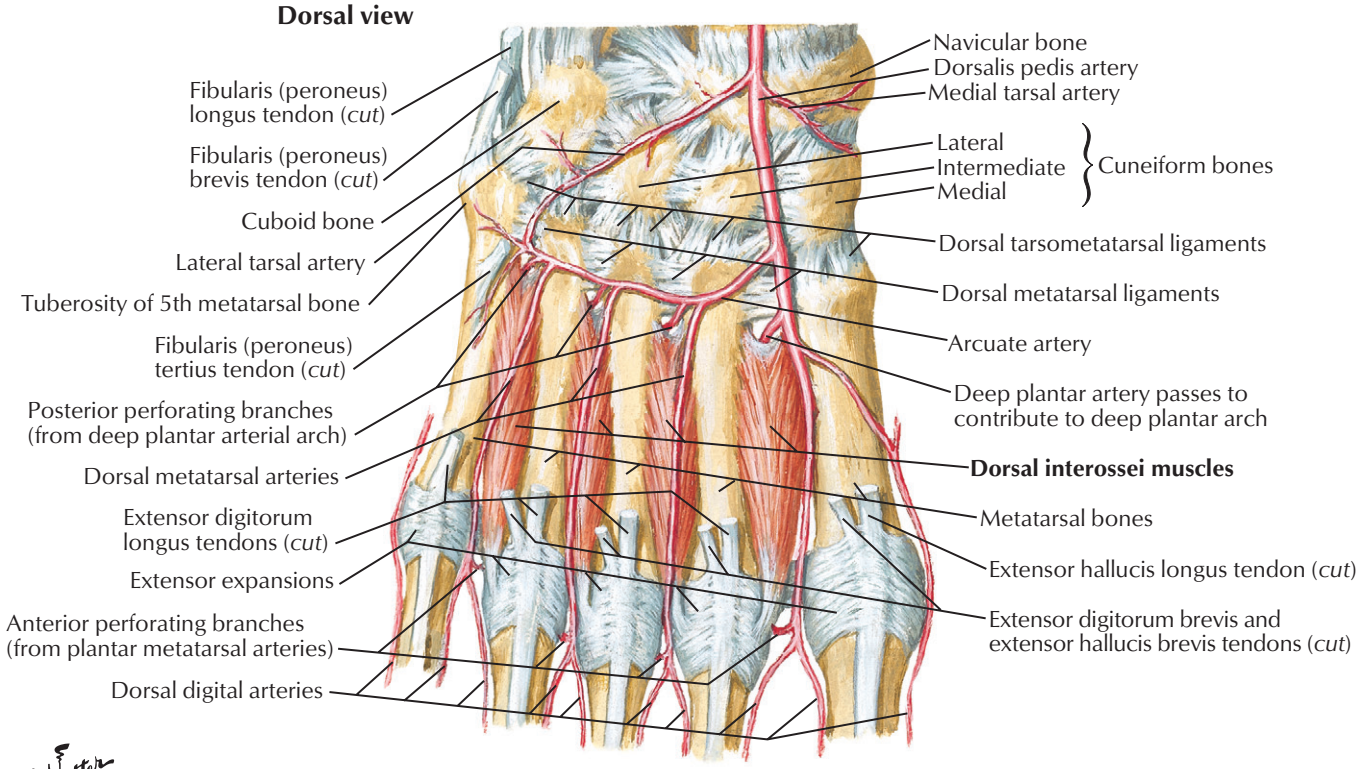


Third layer muscles in bold

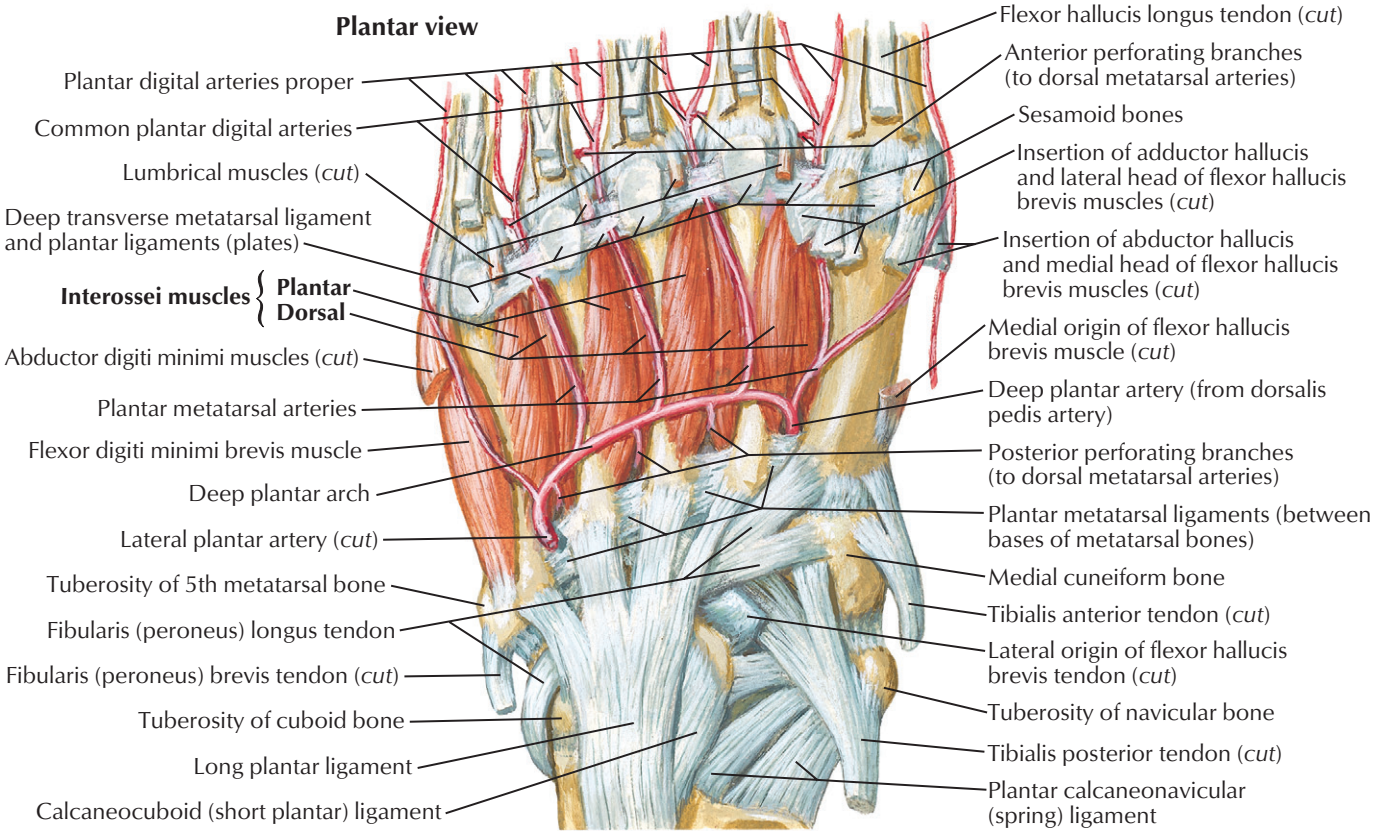
Interosseous Muscles and Deep Arteries of Foot

See also Plates 508, 518

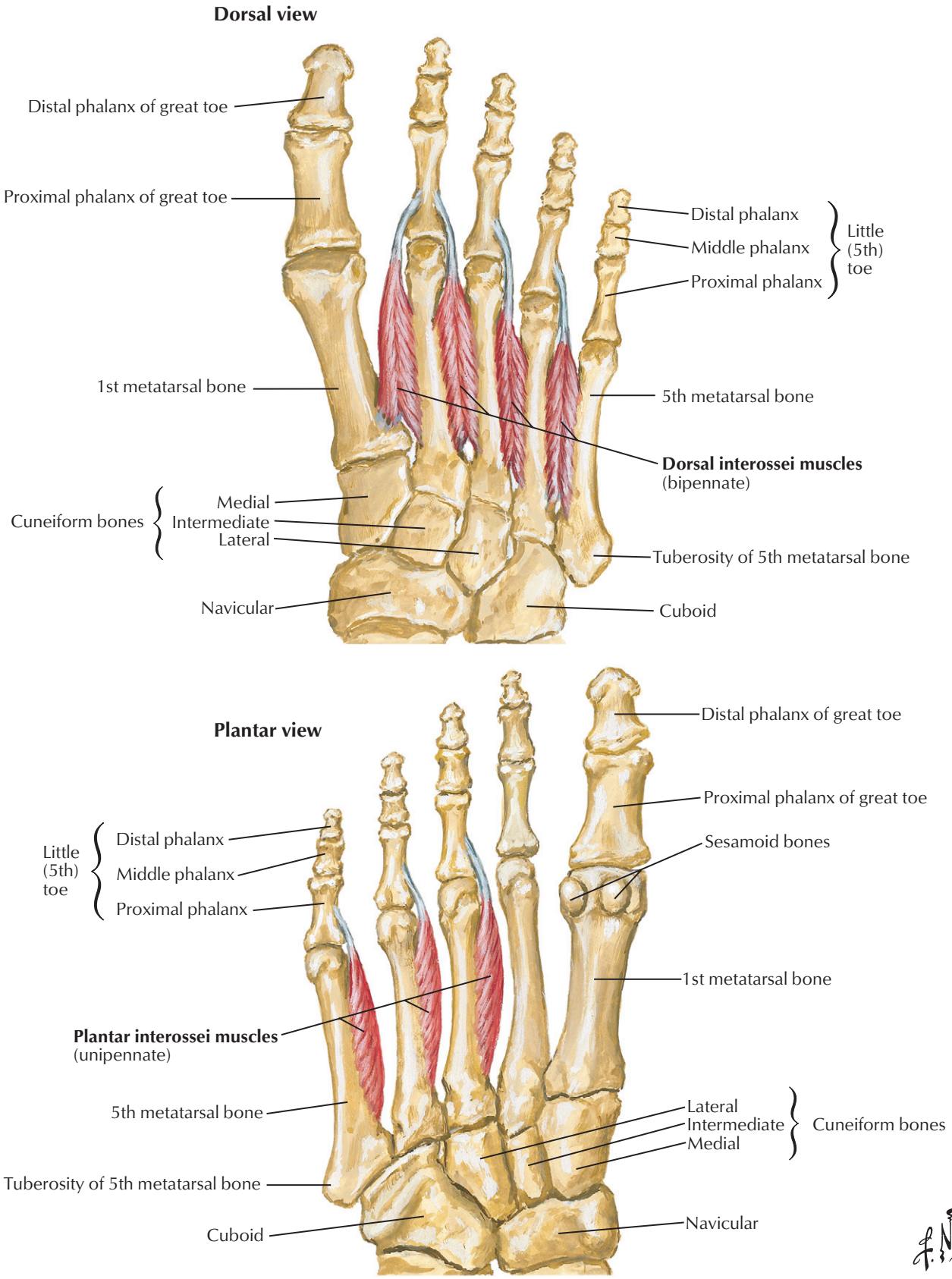
Dorsal view



Plantar view

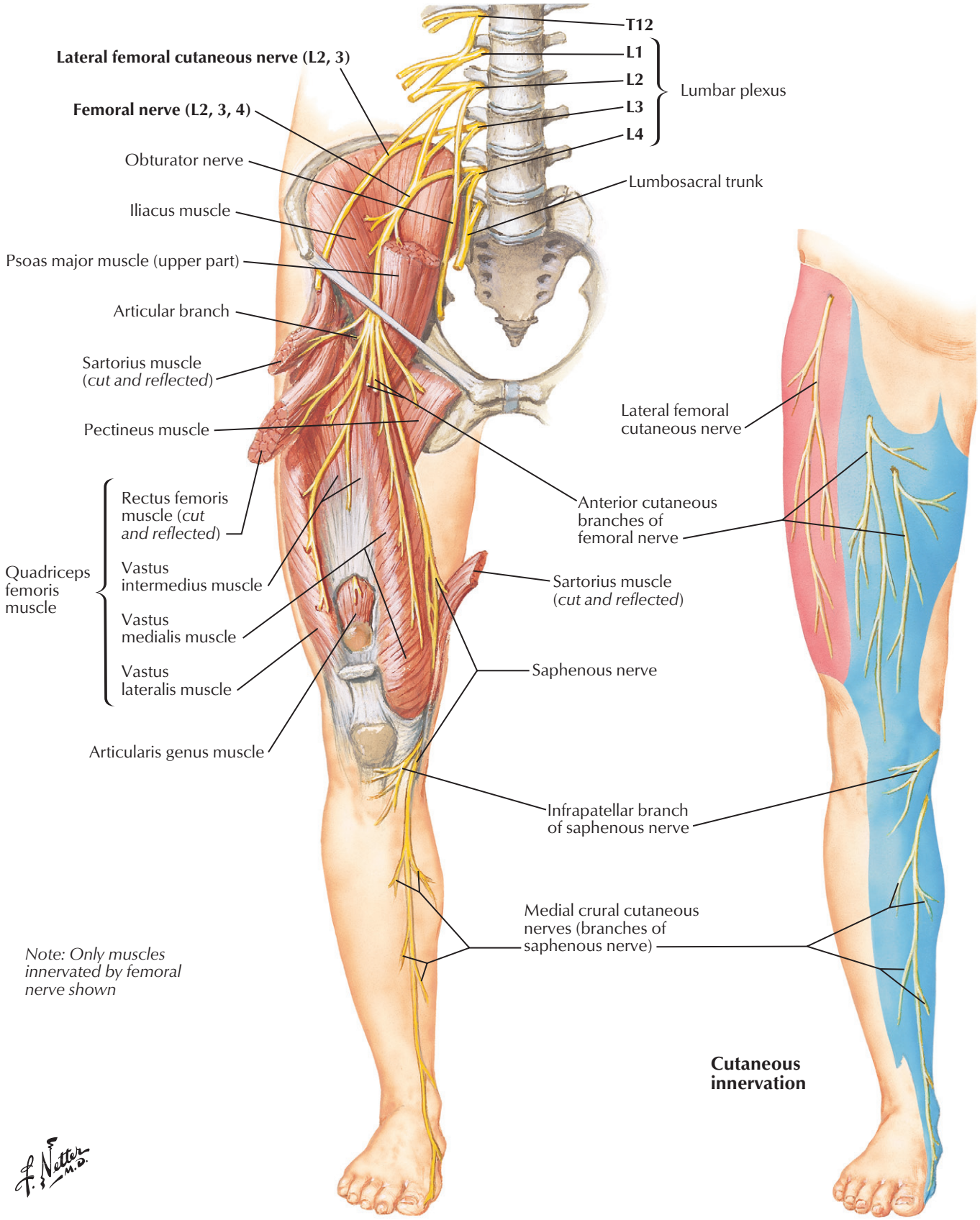


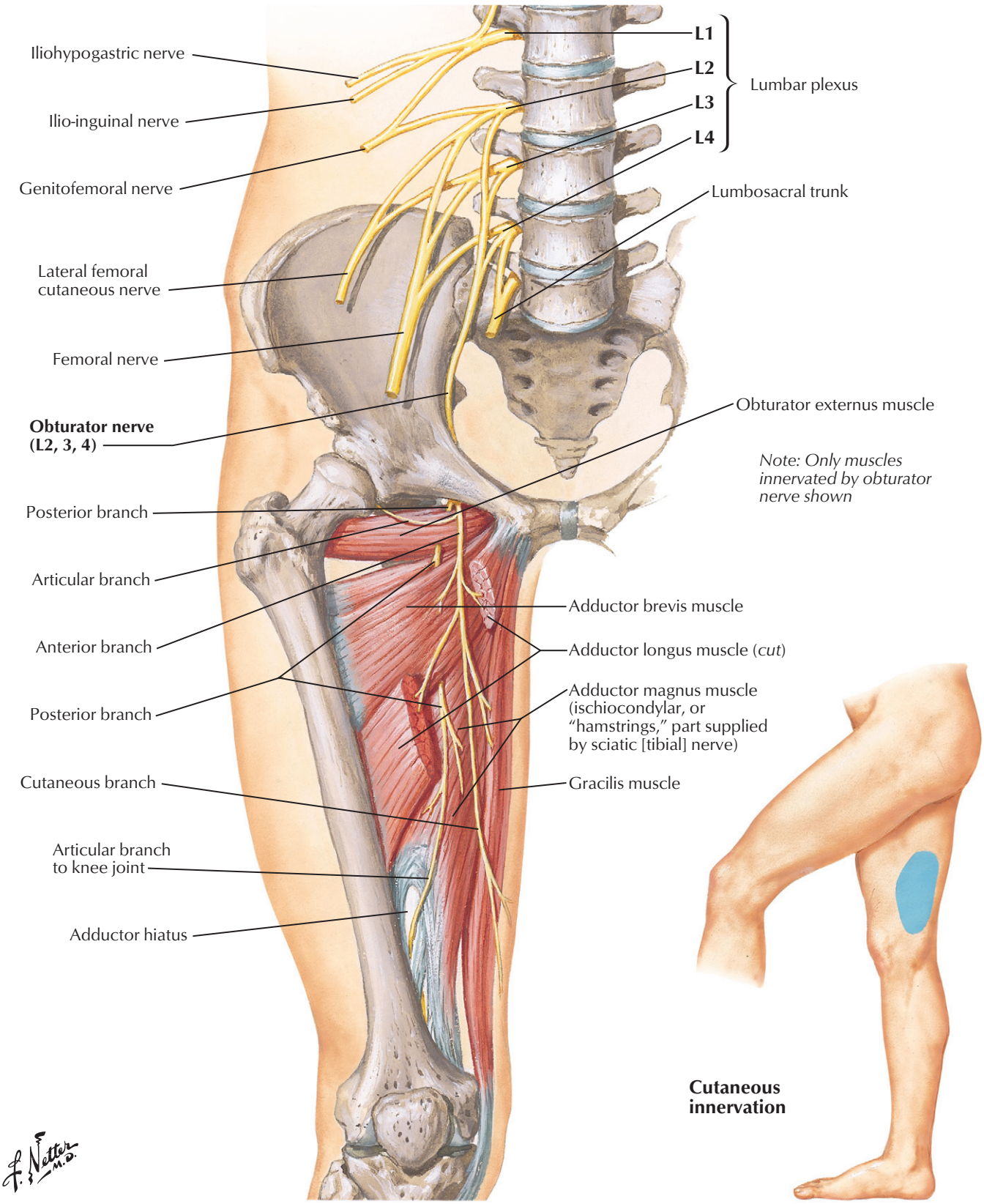
Fourth layer muscles in bold


Dorsal view
Distal phalanx of great toe
Proximal phalanx of great toe
Distal phalanx
Middle phalanx
Proximal phalanx
Little (5th) toe
1st metatarsal bone
5th metatarsal bone
Dorsal interossei muscles (bipennate)
Cuneiform bones
Medial
Intermediate
Lateral
Tuberosity of 5th metatarsal bone
Navicular
Cuboid
Plantar view
Distal phalanx of great toe
Proximal phalanx of great toe
Sesamoid bones
Little (5th) toe
Distal phalanx
Middle phalanx
Proximal phalanx
1st metatarsal bone
Plantar interossei muscles (unipennate)
5th metatarsal bone
Lateral
Intermediate
Medial
Cuneiform bones
Tuberosity of 5th metatarsal bone
Cuboid
Navicular

Femoral Nerve and Lateral Cutaneous Nerve of Thigh

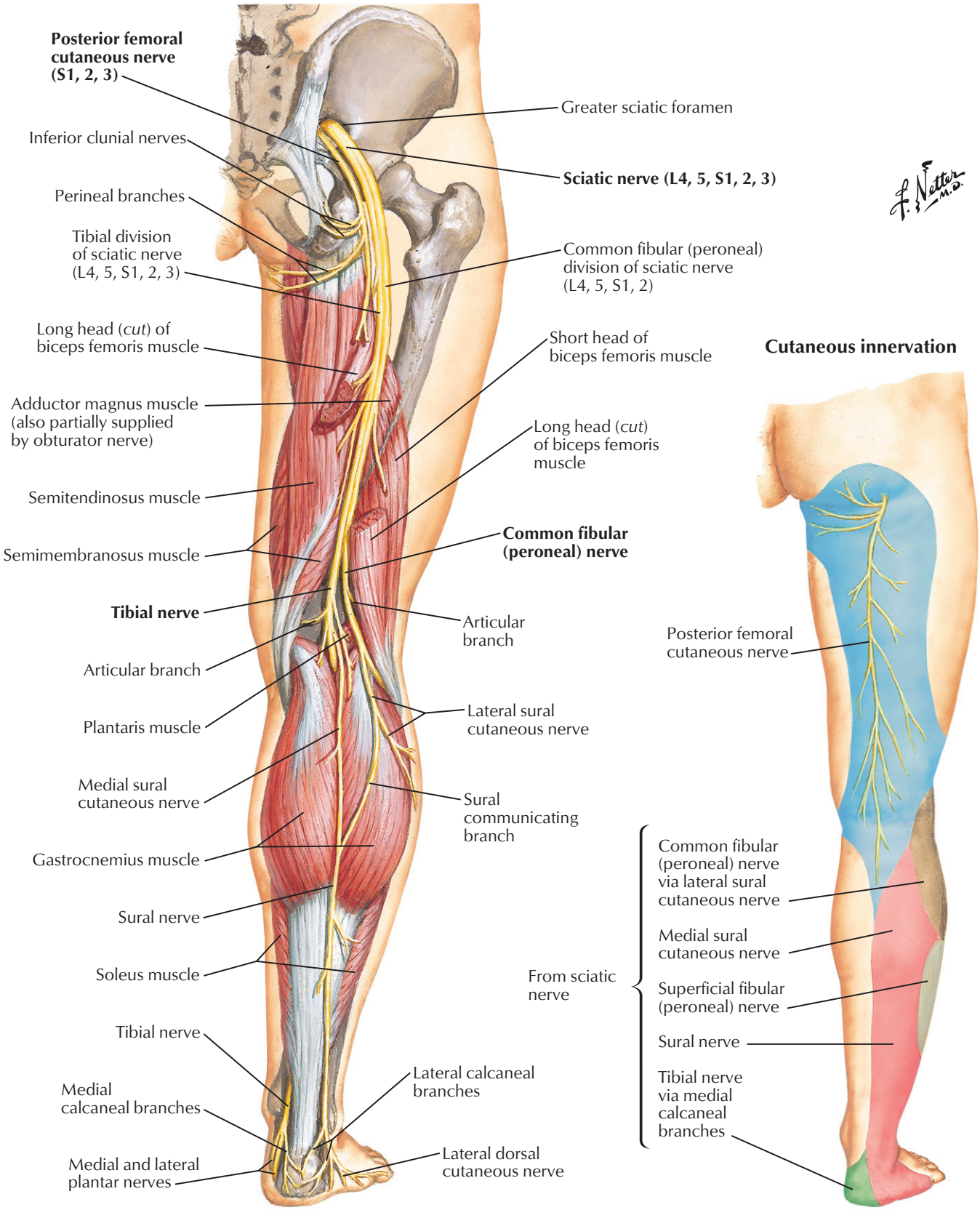
See also Plates 262, 487, 488

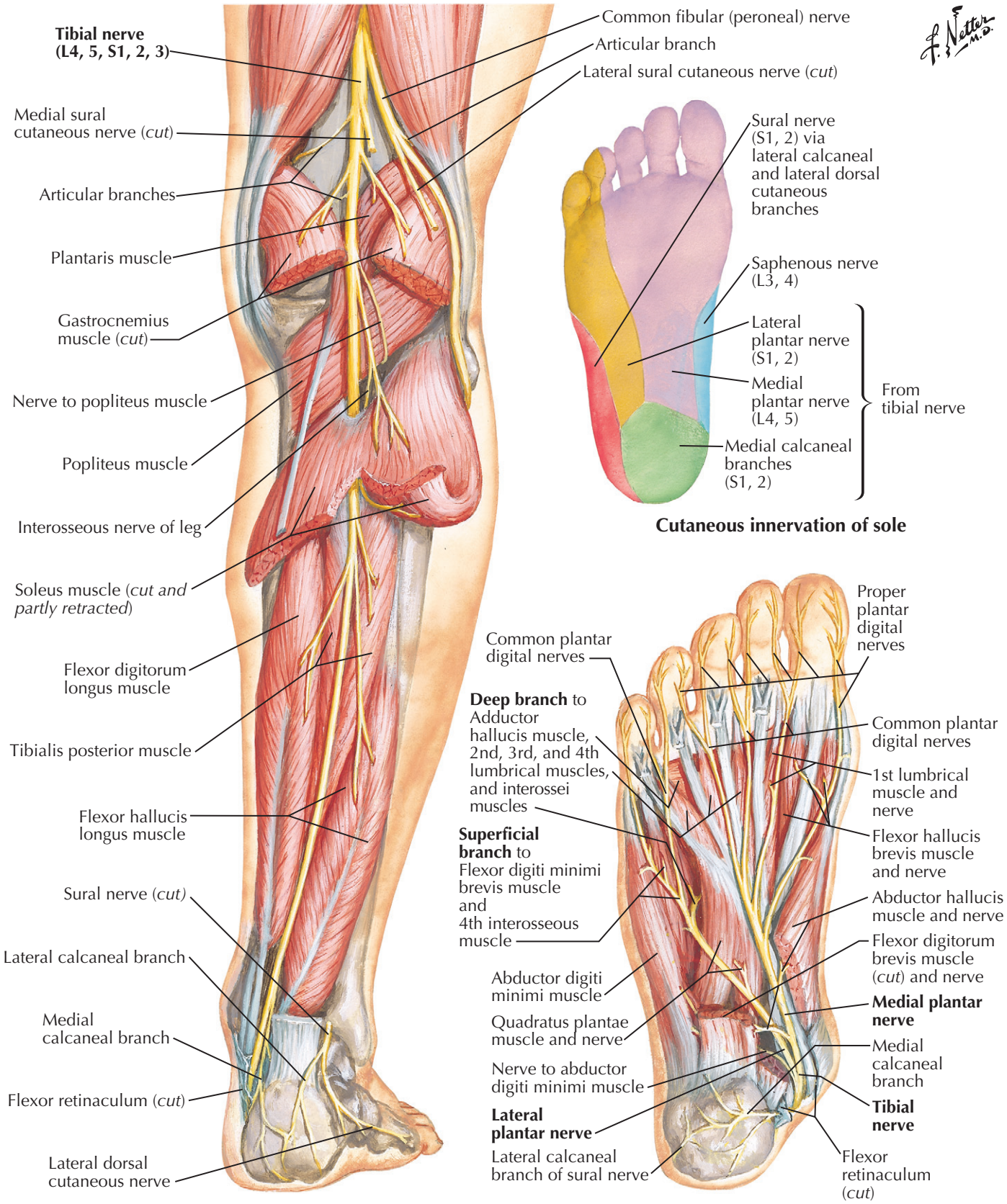



Iliohypogastric nerve
Ilio-inguinal nerve
Genitofemoral nerve
Lateral femoral cutaneous nerve
Femoral nerve
Obturator nerve (L2, 3, 4)
Posterior branch
Articular branch
Anterior branch
Posterior branch
Cutaneous branch
Articular branch to knee joint
Adductor hiatus
L1
L2
L3
L4
Lumbar plexus
Lumbosacral trunk
Obturator externus muscle
Note: Only muscles innervated by obturator nerve shown
Adductor brevis muscle
Adductor longus muscle (cut)
Adductor magnus muscle (ischiocondylar, or "hamstrings," part supplied by sciatic [tibial] nerve)
Gracilis muscle
Cutaneous innervation

Sciatic Nerve and Posterior Cutaneous Nerve of Thigh

See also Plate 489

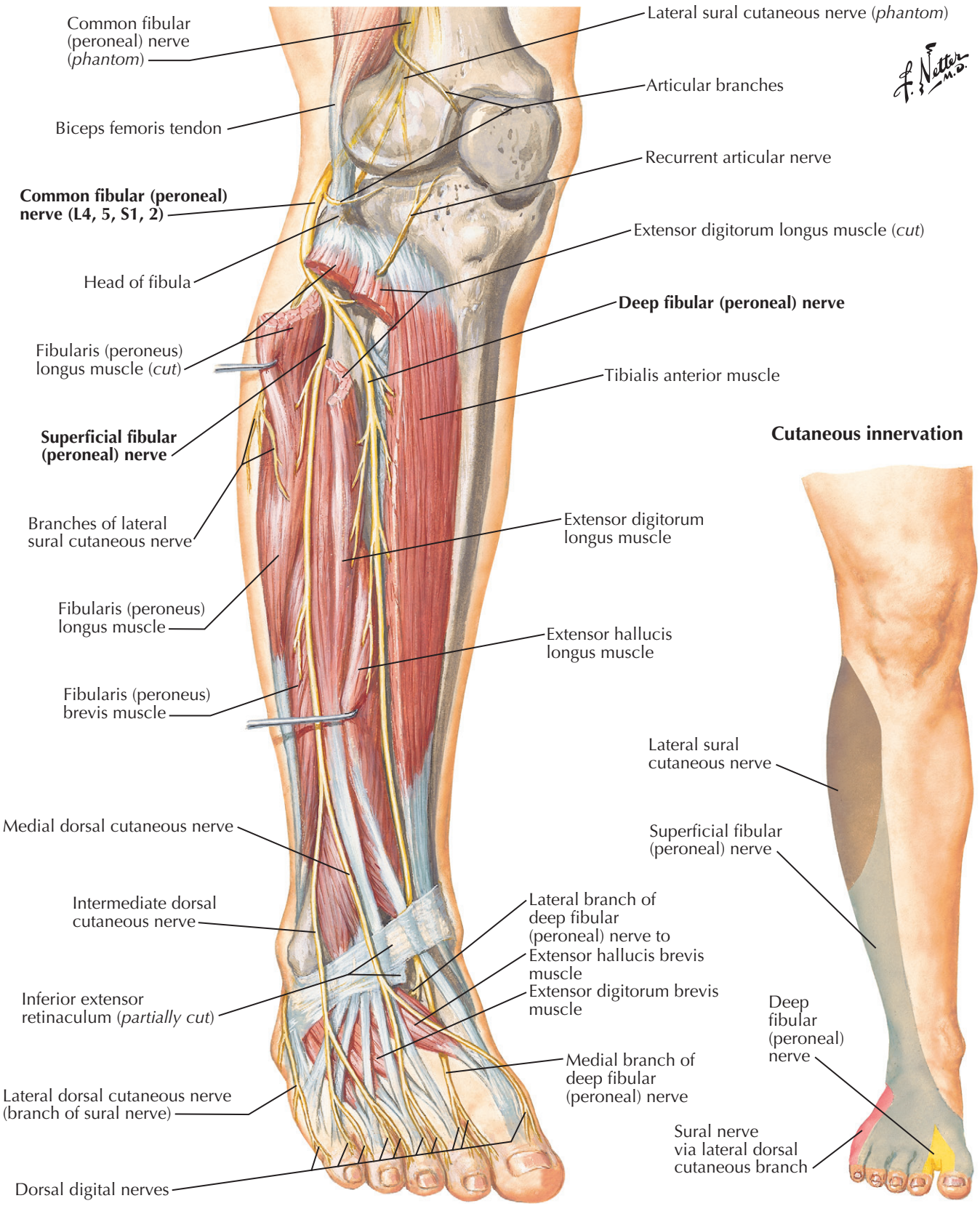




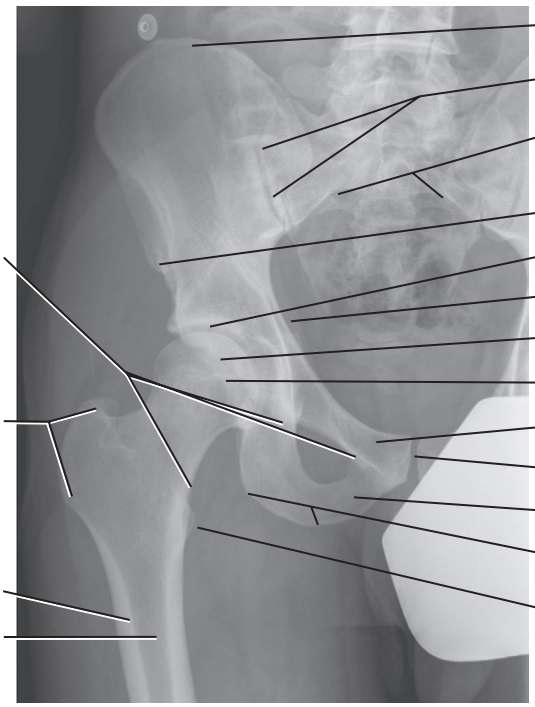
Note: Articular branches not shown

Common Fibular (Peroneal) Nerve

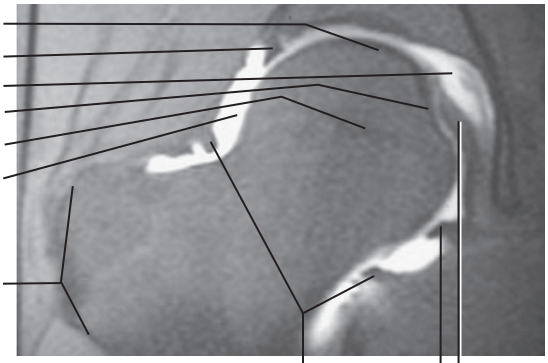
See also Plates 506, 508, 516



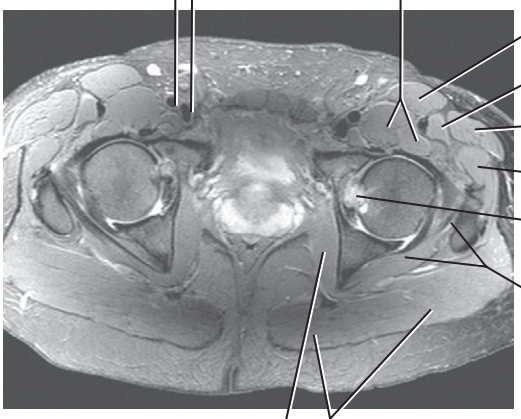
Radiograph



Arthrogram of hip

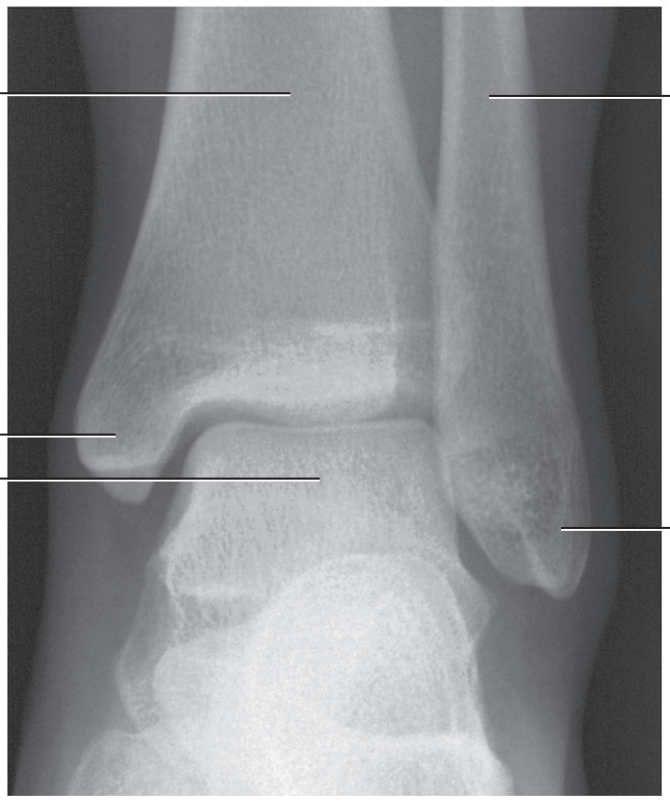


MRI



See also Plates 506, 513, 514





MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Abductor digiti minimi	Medial and lateral tubercles of tuberosity of calcaneus, plantar aponeurosis, and intermuscular septum	Lateral side of base of proximal phalanx of 5th digit	Lateral plantar nerve	Abducts and flexes 5th digit	Medial-lateral plantar artery, plantar metatarsal and plantar digital arteries to 5th digit	Foot
Abductor hallucis	Medial tubercle of tuberosity of calcaneus, flexor retinaculum, and plantar aponeurosis	Medial side of base of proximal phalanx of 1st digit	Medial plantar nerve	Abducts and flexes 1st digit	Medial plantar and 1st plantar metatarsal arteries	Foot
Adductor brevis	Body and inferior pubic ramus	Pectineal line and proximal part of linea aspera of femur	Obturator nerve	Adducts thigh at hip, weak hip flexor	Profunda femoris, medial circumflex femoral, and obturator arteries	Medial thigh
Adductor hallucis	*Oblique head:* bases of 2nd through 4th metatarsals *Transverse head:* ligaments of metatarsophalangeal joints of digits 3-5	Tendons of both heads lateral to side of base of proximal phalanx of 1st digit	Deep branch of lateral plantar nerve	Adducts 1st digit, maintains transverse arch of foot	Medial and lateral plantar arteries and plantar arch, plantar metatarsal arteries	Foot
Adductor longus	Body of pubis inferior to pubic crest	Middle third of linea aspera of femur	Obturator nerve (anterior division)	Adducts thigh at hip	Profunda femoris and medial circumflex femoral arteries	Medial thigh
Adductor magnus	Inferior pubic ramus, ramus of ischium *Hamstring part*: sciatic nerve (tibial division)	Gluteal tuberosity, linea aspera, medial supracondylar line *Hamstring part:* adductor tubercle of femur	*Adductor part:* obturator nerve *Hamstring part:* sciatic nerve (tibial division)	*Adductor part:* adducts and flexes thigh *Hamstring part:* extends thigh	Femoral, profunda femoris, and obturator arteries	Medial thigh
Articularis genus	Distal femur on anterior surface	Suprapatellar bursa	Femoral nerve	Pulls suprapatellar bursa superiorly with extension of knee	Femoral artery	Anterior thigh
Biceps femoris	*Long head:* ischial tuberosity *Short head:* Linea aspera and lateral supracondylar line of femur	Lateral side of head of fibula	*Long head:* sciatic nerve (tibial division) (L5–S2) *Short head:* sciatic nerve (common fibular division)	Flexes and laterally rotates leg, extends thigh at hip	Perforating branches of profunda femoris, inferior gluteal, and medial circumflex femoral arteries	Posterior thigh
Dorsal interossei (four muscles)	Adjacent sides of 1st through 5th metatarsals	*1st:* medial side of proximal phalanx of 2nd digit *2nd through 4th*: lateral sides of digits 2–4	Lateral plantar nerve	Abduct 2nd through 4th toes, flex metatarsophalangeal joints, and extend phalanges	Arcuate artery, dorsal and plantar metatarsal arteries	Foot
Extensor digitorum brevis and extensor hallucis brevis	Superolateral surface of calcaneus, lateral talocalcaneal ligament, cruciate crural ligament	First tendon into dorsal surface of base of proximal phalanx of great toe; other 3 tendons into lateral sides of tendons of extensor digitorum longus to digits 2-4	Deep fibular nerve	Aids the extensor digitorum longus in extending of 4 medial digits at the metatarsophalangeal and interphalangeal joints	Dorsalis pedis, lateral tarsal, arcuate, and fibular arteries	Anterior thigh

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Extensor digitorum longus	Lateral condyle of tibia, proximal 3/4 of anterior surface of interosseous membrane and fibula	Middle and distal phalanges of lateral four digits	Deep fibular nerve	Extends lateral four digits and dorsiflexes foot at ankle	Anterior tibial artery	Anterior leg
Extensor hallucis longus	Middle part of anterior surface of fibula and interosseous membrane	Dorsal aspect of base of distal phalanx of great toe	Deep fibular nerve	Extends great toe, dorsiflexes foot at ankle	Anterior tibial artery	Anterior leg
Fibularis peroneus brevis	Distal 2/3 of lateral surface of fibula	Dorsal surface of tuberosity on lateral side of 5th metatarsal	Superficial fibular nerve	Everts foot and weakly plantarflexes foot at ankle	Anterior tibial and fibular arteries	Lateral leg
Fibularis peroneus longus	Head and proximal 2/3 of lateral fibula	Plantar base of 1st metatarsal and medial cuneiform	Superficial fibular nerve	Everts foot and weakly plantarflexes foot at ankle	Anterior tibial and fibular arteries	Lateral leg
Fibularis peroneus tertius	Distal third of anterior surface of fibula and interosseous membrane	Dorsum of base of 5th metatarsal	Deep fibular nerve	Dorsiflexes foot at ankle and aids in eversion of foot	Anterior tibial artery	Anterior leg
Flexor digiti minimi brevis	Base of 5th metatarsal	Lateral base of proximal phalanx of 5th digit	Superficial branch of lateral plantar nerve	Flexes proximal phalanx of 5th digit	Lateral plantar artery, plantar digital artery to 5th digit, arcuate artery	Foot
Flexor digitorum brevis	Medial tubercle of tuberosity of calcaneus, plantar aponeurosis, and intermuscular septum	Both sides of middle phalanges of lateral four digits	Medial plantar nerve	Flexes 2nd through 5th digits	Medial and lateral plantar arteries and plantar arch, plantar metatarsal and plantar digital arteries	Foot
Flexor digitorum longus	Medial part of posterior tibia inferior to soleal line	Plantar bases of distal phalanges of lateral four digits	Tibial nerve	Flexes lateral four digits and plantarflexes foot at ankle; supports longitudinal arches of foot	Posterior tibial artery	Posterior leg
Flexor hallucis brevis	Plantar surfaces of cuboid and lateral cuneiform	Both sides of base of proximal phalanx of 1st digit	Medial plantar nerve	Flexes proximal phalanx of 1st digit	Medial plantar artery, first plantar metatarsal artery	Foot
Flexor hallucis longus	Distal 2/3 of posterior fibula and interosseous membrane	Base of distal phalanx of great toe (hallux)	Tibial nerve	Flexes all joints of great toe, weakly plantarflexes foot at ankle	Fibular artery	Posterior leg
Gastrocnemius	*Lateral head:* lateral aspect of lateral condyle of femur *Medial head:* popliteal surface above medial condyle of femur	Posterior aspect of calcaneus via calcaneal tendon	Tibial nerve	Plantarflexes foot at ankle joint, assists in flexion of knee joint, raises heel during walking	Popliteal and posterior tibial arteries	Posterior leg
Gluteus maximus	Ilium posterior to posterior gluteal line, dorsal surface of sacrum and coccyx, sacrotuberous ligament	Most fibers end in iliotibial tract that inserts into lateral condyle of tibia; some fibers insert into gluteal tuberosity of femur	Inferior gluteal nerve	Extends flexed thigh, assists in lateral rotation, and abducts thigh	Inferior gluteal arteries mainly, and superior gluteal arteries occasionally	Gluteal region

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Gluteus medius	Lateral surface of ilium between anterior and posterior gluteal lines	Lateral surface of greater trochanter of femur	Superior gluteal nerve	Abducts and medially rotates thigh at hips; steadies pelvis on leg when opposite leg is raised	Superior gluteal artery	Gluteal region
Gluteus minimus	Lateral surface of ilium between anterior and inferior gluteal lines	Anterior surface of greater trochanter of femur	Superior gluteal nerve	Abducts and medially rotates thigh at hips; steadies pelvis on leg when opposite leg is raised	Main trunk and deep branch of superior gluteal artery	Gluteal region
Gracilis	Body and inferior ramus of pubis	Superior part of medial surface of tibia	Obturator nerve	Adducts thigh, flexes and medially rotates leg	Profunda femoris artery, medial circumflex femoral artery	Medial thigh
Iliacus (Iliopsoas)	Superior 2/3 of iliac fossa, iliac crest, ala of sacrum, anterior sacro-iliac ligaments	Lesser trochanter of femur and shaft inferior to it, to psoas major tendon	Femoral nerve	Flexes thigh at hips and stabilizes hip joint, acts with psoas major	Iliac branches of iliolumbar artery	Anterior thigh
Inferior gamellus	Ischial tuberosity	Medial surface of greater trochanter of femur	Nerve to quadratus femoris	Laterally rotates extended thigh at the hip	Medial circumflex femoral artery	Gluteal region
Lumbricals	Tendons of flexor digitorum longus	Medial side of dorsal digital expansions of lateral 4 digits	*Medial one:* medial plantar nerve *Lateral three*: lateral plantar nerve	Flexes proximal phalanges at MTP joint, extends phalanges at PIP and DIP joints	Lateral plantar artery and plantar metatarsal arteries	Foot
Obturator externus	Margins of obturator foramen, obturator membrane	Trochanteric fossa of femur	Obturator nerve	Laterally rotates thigh, stabilizes head of femur in acetabulum	Medial circumflex femoral artery, obturator artery	Medial thigh
Obturator internus	Pelvic surface of obturator membrane and surrounding bone	Medial surface of greater trochanter of femur	Nerve to obturator internus	Laterally rotates extended thigh, abducts flexed thigh at hip	Internal pudendal and obturator arteries	Gluteal region
Pectineus	Superior ramus of pubis	Pectineal line of femur	Femoral nerve and sometimes obturator nerve	Adducts and flexes thigh at hip	Medial circumflex femoral artery, obturator artery	Medial thigh
Piriformis	Anterior surface of sacral segments 2–4, sacrotuberous ligament	Superior border of greater trochanter of femur	Ventral rami of L5, S1, S2	Laterally rotates extended thigh, abducts flexed thigh at hip	Superior and inferior gluteal arteries, internal pudendal artery	Gluteal region
Plantar interossei (three muscles)	Bases and medial sides of 3rd through 5th metatarsals	Medial sides of bases of proximal phalanges of 3rd through 5th digits	Lateral plantar nerve	Adduct digits (2–4) and flex metatarsophalangeal joint and extend phalanges	Lateral plantar artery and plantar arch, plantar metatarsal and plantar digital arteries	Foot
Plantaris	Inferior end of lateral supracondylar line of femur and oblique popliteal ligament	Posterior aspect of calcaneus via calcaneal tendon	Tibial nerve	Weakly assists gastrocnemius	Popliteal artery	Posterior leg
Popliteus	Lateral aspect of lateral condyle of femur, lateral meniscus	Posterior tibia superior to soleal line	Tibial nerve (L4–S1)	Weakly flexes knee and unlocks it by rotating femur on fixed tibia	Inferior medial and lateral genicular arteries	Posterior leg
Psoas major (Iliopsoas)	Transverse processes of lumbar vertebrae, sides of bodies of T12–L5 vertebrae, intervening intervertebral discs	Lesser trochanter of femur	Ventral rami of first lumbar nerve	Acting superiorly with iliacus, flexes hip; acting inferiorly, flexes vertebral column laterally; used to balance trunk in sitting position; acting inferiorly with iliacus, flexes trunk	Lumbar branches of iliolumbar artery	Anterior thigh
Quadratus femoris	Lateral margin of ischial tuberosity	Quadrate tubercle on intertrochanteric crest of femur	Nerve to quadratus femoris	Laterally rotates thigh at hip	Medial circumflex femoral artery	Gluteal region

MUSCLE	PROXIMAL ATTACHMENT (ORIGIN)	DISTAL ATTACHMENT (INSERTION)	INNERVATION	MAIN ACTIONS	BLOOD SUPPLY	MUSCLE GROUP
Quadratus plantae	Medial and lateral sides of plantar surface of calcaneus	Posterolateral edge of flexor digitorum longus tendon	Lateral plantar nerve	Corrects for oblique pull of flexor digitorum longus tendon, thus assists in flexion of toes	Medial and lateral plantar arteries and deep plantar arterial arch	Foot
Rectus femoris (quadriceps)	Anterior inferior iliac spine and ilium superior to acetabulum	Base of patella and to tibial tuberosity via patellar ligament	Femoral nerve	Extends leg at knee joint and flexes thigh at hip joint	Profunda femoris and lateral circumflex femoral arteries	Anterior thigh
Sartorius	Anterior superior iliac spine and superior part of notch below it	Superior part of medial surface of tibia	Femoral nerve	Abducts, laterally rotates, and flexes thigh; flexes knee joint	Femoral artery	Anterior thigh
Semimembranosus	Ischial tuberosity	Posterior part of medial condyle of tibia	Sciatic nerve (tibial division)	Flexes leg, extends thigh	Perforating branch of profunda femoris and medial circumflex femoral arteries	Posterior thigh
Semitendinosus	Ischial tuberosity	Superior part of medial surface of tibia	Sciatic nerve (tibial division)	Flexes leg, extends thigh	Perforating branch of profunda femoris and medial circumflex femoral arteries	Posterior thigh
Soleus	Posterior aspect of head of fibula, proximal 1/4 of posterior surface of fibula, soleal line of tibia	Posterior aspect of calcaneus via calcaneal tendon	Tibial nerve	Plantarflexes foot at ankle, stabilizes leg over foot	Popliteal, posterior tibial, and fibular arteries	Posterior leg
Superior gemellus	Outer surface of ischial spine	Medial surface of greater trochanter of femur	Nerve to obturator internus	Laterally rotates extended thigh at the hip	Inferior gluteal and internal pudendal arteries	Gluteal region
Tensor fasciae latae	Anterior superior iliac spine and anterior part of iliac crest	Iliotibial tract that attaches to lateral condyle of tibia	Superior gluteal nerve	Abducts, medially rotates, and flexes thigh at hip; helps to keep knee extended	Ascending branch of lateral circumflex femoral artery	Gluteal region
Tibialis anterior	Lateral condyle, proximal half of lateral tibia, interosseous membrane	Medial plantar surfaces of medial cuneiform and base of 1st metatarsal	Deep fibular nerve	Dorsiflexes foot at ankle and inverts foot	Anterior tibial artery	Anterior leg
Tibialis posterior	Posterior tibia below soleal line, interosseous membrane, proximal half of posterior fibula	Tuberosity of navicular bone, all cuneiforms, cuboid, and bases of 2nd through 4th metatarsals	Tibial nerve	Plantarflexes foot at ankle and inverts foot	Fibular artery	Posterior leg
Vastus intermedius (quadriceps)	Anterior and lateral surfaces of body of femur	Base of patella and to tibial tuberosity via patellar ligament	Femoral nerve	Extends leg at knee joint	Lateral circumflex femoral and profunda femoris arteries	Anterior thigh
Vastus lateralis (quadriceps)	Greater trochanter, lateral lip of linea aspera of femur	Base of patella and to tibial tuberosity via patellar ligament	Femoral nerve	Extends leg at knee joint	Lateral circumflex femoral and profunda femoris arteries	Anterior thigh
Vastus medialis (quadriceps)	Intertrochanteric line, medial lip of linea aspera of femur	Base of patella and to tibial tuberosity via patellar ligament	Femoral nerve	Extends leg at knee joint	Femoral and profunda femoris arteries	Anterior thigh

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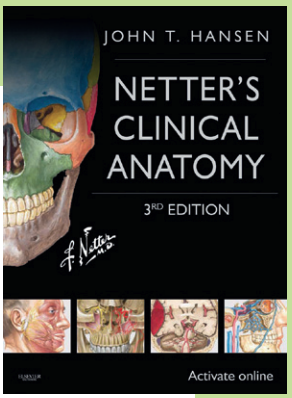
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chapter 6

Lower Limb

1. INTRODUCTION
2. SURFACE ANATOMY
3. HIP
4. GLUTEAL REGION
5. THIGH
6. LEG
7. ANKLE AND FOOT
8. LOWER LIMB MUSCLE SUMMARY AND GAIT
9. LOWER LIMB ARTERY AND VEIN SUMMARY
10. LOWER LIMB NERVE SUMMARY
11. EMBRYOLOGY
CHALLENGE YOURSELF QUESTIONS

1. INTRODUCTION

As with the upper limb in Chapter 7, this chapter approaches our study of the lower limb by organizing its anatomical structures into functional compartments. The thigh and leg each are divided into three functional compartments, each containing muscles and neurovascular structures. The lower limb subserves the following features:

- **Popliteal fossa:** the region
- **Gastrocnemius muscles:** the muscle mass
- **Calcaneal (Achilles) tendon:** the promi-
- **Small saphenous vein:** drains blood from

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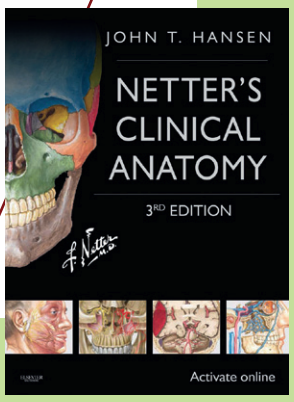
1. An elderly patient who has been minimally ambulatory is transported to the clinic with a swollen lower limb and evidence of a deep vein thrombosis. Your examination reveals a sizable clot in her small saphenous vein, and you are concerned that a thromboembolus might originate from this clot and pass to her heart and lungs. After it exits the small saphenous vein, the thromboembolus would next pass into which of the following veins on its journey to the heart?
   A. Deep femoral
   B. External iliac
   C. Femoral
   D. Great saphenous
   E. Popliteal

2. An obese 48-year-old woman presents with a painful lump in her proximal thigh, just medial to the femoral vessels. Examination reveals the herniation of some abdominal viscera, which passes under the inguinal ligament. Through which of the following openings has this hernia passed to enter her thigh?
   A. Deep inguinal ring
   B. Femoral ring
   C. Fossa ovalis
   D. Obturator
   E. Super

4. A football player receives a blow to the lateral aspect of his weight-bearing right leg and immediately feels his knee give way. Under extreme pain, he is carried from the field and immediately examined by the team physician, who is able to move the player's right tibia forward excessively compared to the uninjured leg. Which of the following ligaments is injured?
   A. Anterior cruciate
   B. Fibular collateral
   C. Posterior cruciate
   D. Tibial collateral
   E. Transverse

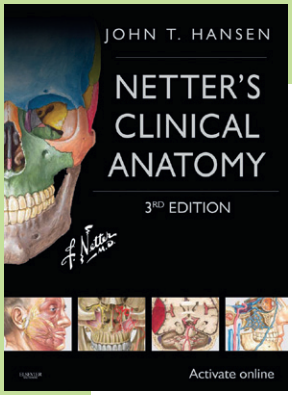
5. During a routine physical exam, the physician taps a patient's patellar ligament with a hammer and elicits a knee-jerk reflex. Which of the following nerves

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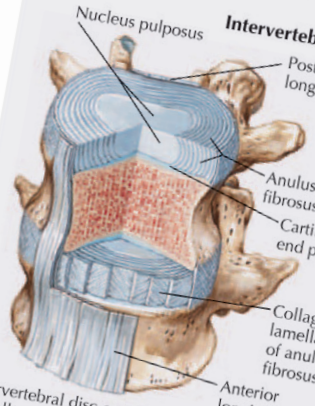
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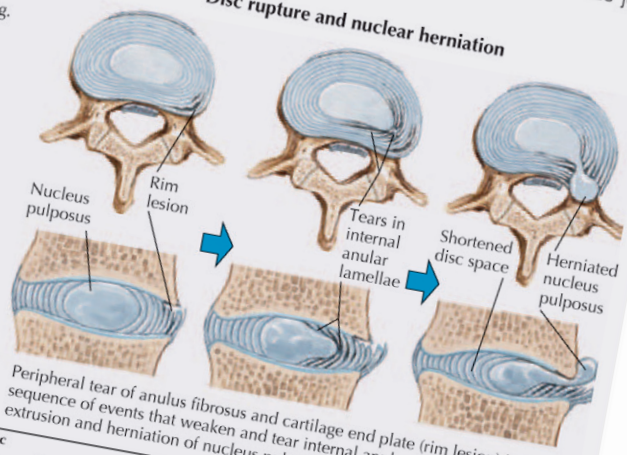


Intervertebral Disc Herniation—cont'd

The most common sites for disc herniation in the cervical region are the C5-C6 and C6-C7 levels, resulting in shoulder and upper limb pain. In the lumbar region the primary sites are the L4-L5 and L5-S1 levels. Lumbar disc herniation is much more common than cervical herniation and results in pain over the sacro-iliac joint, hip, posterior thigh, and leg.



Intervertebral disc composed of central nuclear zone of collagen and hydrated proteoglycans surrounded by concentric lamellae of collagen fibers



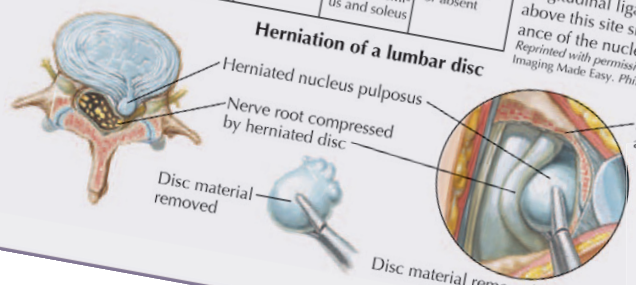
Peripheral tear of anulus fibrosus and cartilage end plate (rim lesion) initiates sequence of events that weaken and tear internal anular lamellae, allowing extrusion and herniation of nucleus pulposus.

Level of herniation	Clinical features of herniated lumbar disc: Pain	Numbness	Weakness	Atrophy	Reflexes
L4-L5 disc; 5th lumbar n. root	Over sacro-iliac joint, hip, lateral thigh, and leg	Lateral leg, first 3 toes	Dorsiflexion of great toe and foot; difficulty walking on heels; foot-drop may occur	Minor	Changes uncommon in knee and ankle jerks, but internal hamstring reflex diminished or absent
L5-S1 disc; 1st sacral n. root	Over sacro-iliac joint, hip, postero-lateral thigh, and leg to heel	Back of calf, lateral heel, foot to toe	Plantar-flexion of foot and great toe may be affected; difficulty walking on toes	Gastrocnemi-us and soleus	Ankle jerk diminished or absent



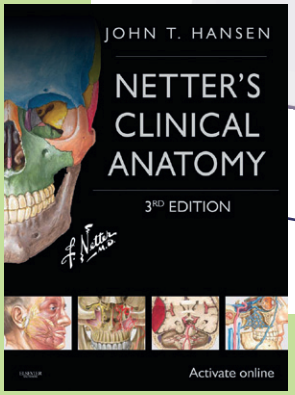
Herniation of L4–L5 intervertebral disc (*white arrows*) with some displacement of the posterior longitudinal ligament (*black arrow*). The two discs above this site show the normal hydrated appearance of the nucleus pulposus.

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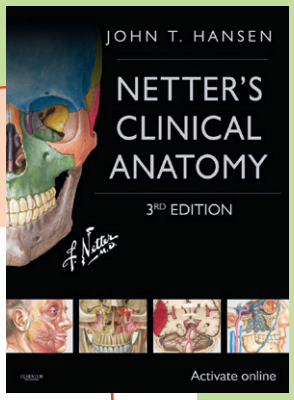
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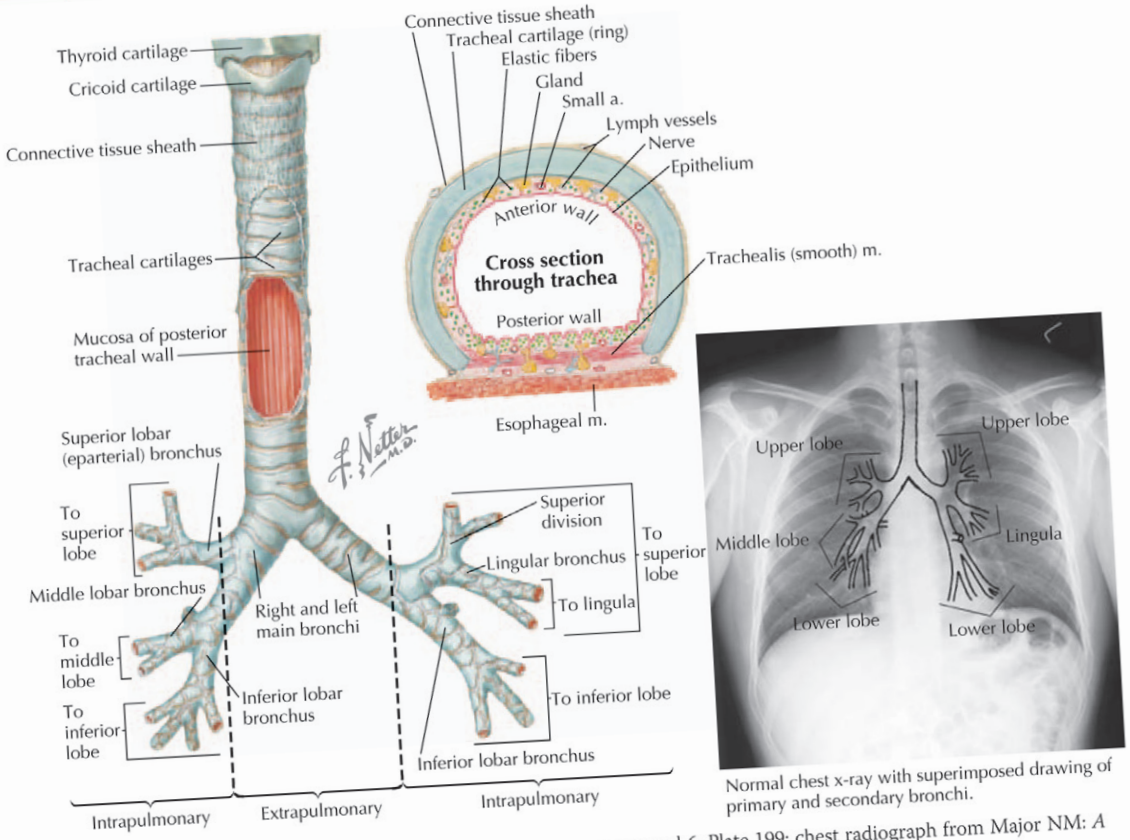
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Normal chest x-ray with superimposed drawing of primary and secondary bronchi.

FIGURE 3-13 Trachea and Bronchi. (From *Atlas of human anatomy,* ed 6, Plate 199; chest radiograph from Major NM: *A practical approach to radiology,* Philadelphia, 2006, Saunders.)

TABLE 3-8 Features of the Trachea and Bronchi

STRUCTURE	CHARACTERISTICS
Trachea	Approximately 5 inches (10 cm) long and 1 inch in diameter; courses inferiorly anterior to esophagus and posterior to aortic arch
Cartilaginous rings	Are 16-20 C-shaped rings
Bronchus	Divides into right and left main (primary) bronchi at level of sternal angle of Louis
Right bronchus	Shorter, wider, and more vertical than left bronchus; aspirated foreign objects more likely to nto right bronchus l, keel-like cartilage at ation of trachea lobes of each lung (three ht, two on left) bronchopulmonary ents (10 for each lung)

5. PERICARDIUM AND HEART

The Pericardium

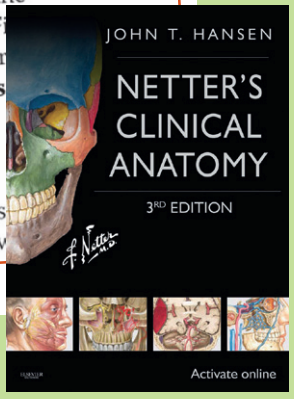
The pericardium and heart lie within the **middle mediastinum.** The heart is enclosed within a fibroserous pericardial pouch that extends and blends into the adventitia of the great vessels that enter or leave the heart. The pericardium has a **fibrous outer layer** that is lined internally by a serous layer, the **parietal serous layer,** which then reflects onto the heart and becomes the **visceral serous layer,** which is the outer covering of the heart itself, also known as the **epicardium** (F 3-14 and Table 3-9). These two serous layers for a potential space known as the **pericardial s (cavity).**

The Heart

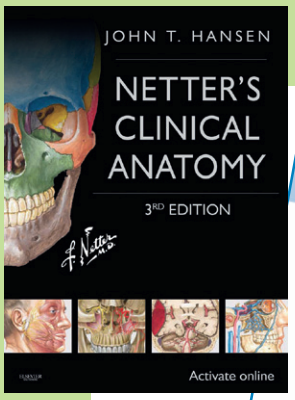
The heart is essentially two muscular pumps series. The two atria contract in unison, follov

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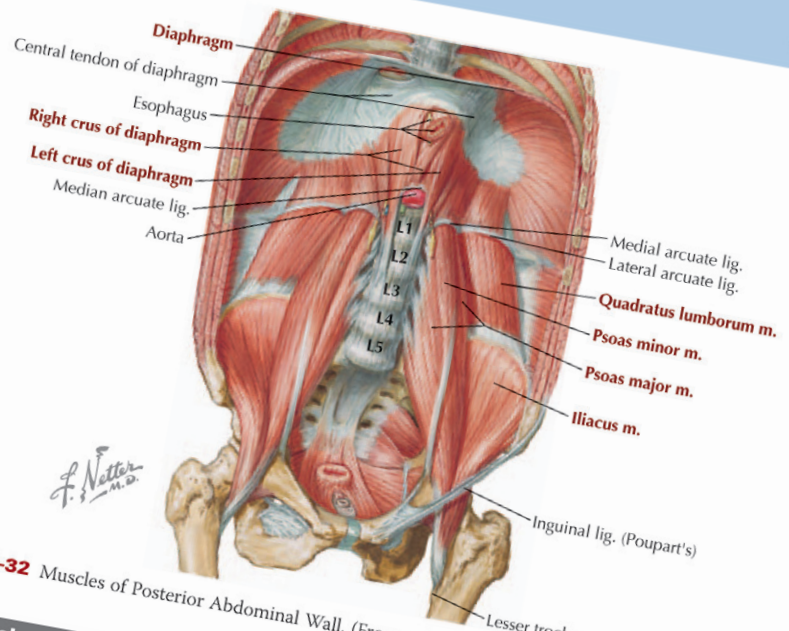


FIGURE 4-32 Muscles of Posterior Abdominal Wall. (From *Atlas of human anatomy*, ed 6, Plate 258.)

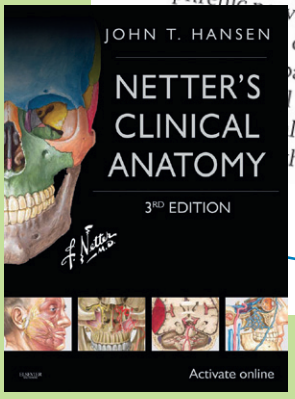
TABLE 4-10 Muscles of Posterior Abdominal Wall

MUSCLE	SUPERIOR ATTACHMENT (ORIGIN)	INFERIOR ATTACHMENT (INSERTION)	INNERVATION	ACTIONS
Psoas major	Transverse processes of lumbar vertebrae; sides of bodies of T12-L5 vertebrae, and intervening intervertebral discs	Lesser trochanter of femur	Lumbar plexus via ventral branches of L2-L4 nerves	Acting superiorly with iliacus, flexes hip; acting inferiorly, flexes vertebral column laterally; used to balance trunk in sitting position; acting inferiorly with iliacus, flexes trunk
Iliacus	Superior two thirds of iliac fossa, ala of sacrum, and anterior sacro-iliac ligaments	Lesser trochanter of femur and shaft inferior to it and to psoas major tendon	Femoral nerve (L2-L4)	Flexes hip and stabilizes hip joint; acts with psoas major
Quadratus lumborum	Medial half of inferior border of 12th rib and tips of lumbar transverse processes	Iliolumbar ligament and internal lip of iliac crest	Ventral branches of T12 and L1-L4 nerves	Extends and laterally flexes vertebral column; fixes 12th rib during inspiration
Diaphragm	Thoracic outlet: xiphoid, lower six costal cartilages, L1-L3 vertebrae	Converges into central tendon	Phrenic nerve (C3-C5)	Draws central tendon down and forward during inspiration

abdominal aorta. The **inferior vena cava** passes through the diaphragm at the T8 vertebral level to enter the right atrium of the heart. The right phrenic n... ve may accompany the IVC as it passes diaphragm, which it innervates. The ...asses through the diaphragm at the ...l level, along with the anterior and ...l trunks and left gastric vessels. The ...hrough the diaphragm at the T12 vertebral level and is accompanied by the thor... duct and often the azygos vein a... superiorly.

Kidneys and Adrenal (Suprarenal) Glands

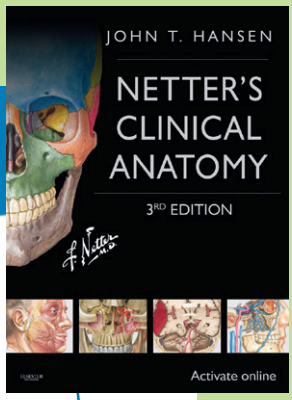
The kidneys and adrenal glands are ... neal organs that receive a rich arterial supply...



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inguinal region, rectus sheath, and lateral thoracic wall. Most of its connections ultimately drain into the **axillary vein (4)** and then into the **subclavian vein**, **brachiocephalic veins**, which form the **superior vena cava**, and then into the **heart (6).** The inferior epigastric veins (from the external iliac veins) enter the posterior rectus sheath and course cranially above the umbilicus as the superior epigastric veins and then anastomose with the internal thoracic veins that drain into the subclavian veins (Fig. 4-3).

The superficial veins can become enlarged during portal hypertension, when the venous flow through the liver is compromised. Important **portosystemic anastomoses** between the portal system and caval system can allow venous blood to gain access to the caval veins (both deep and superficial veins) to assist in returning blood to the heart.

Variations in the venous pattern and in the number of veins and their size are common, so it is best to understand the major venous channels and realize that smaller veins often are more variable.

Hepatic Portal System of Veins

The hepatic portal system of veins drains the abdominal GI tract and two of its accessory organs (pancreas and gallbladder) and the spleen (immune system organ) (Fig. 4-40). This blood then collects largely in the liver, where processing of absorbed GI contents takes place. (However, most fats are absorbed by the lymphatics and returned via the thoracic duct to the venous system in the neck, at the junction of the left internal jugular and left

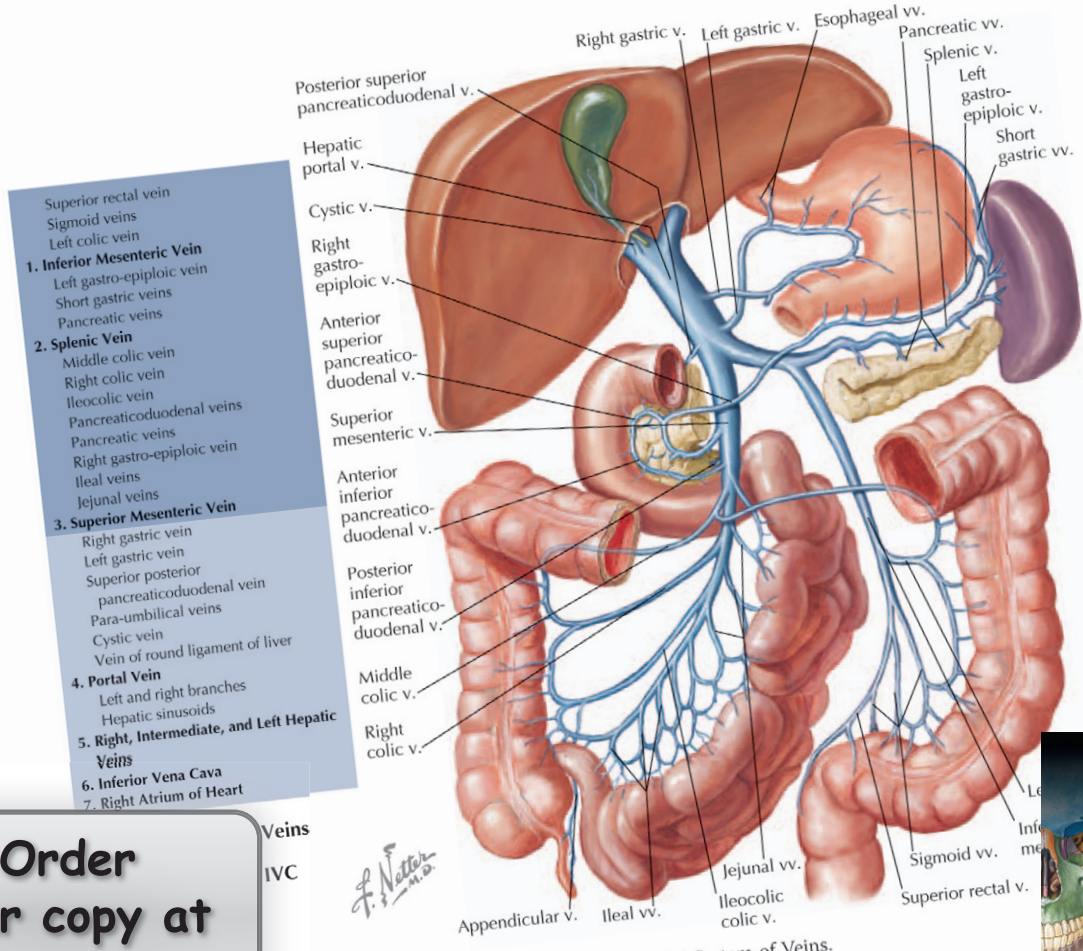
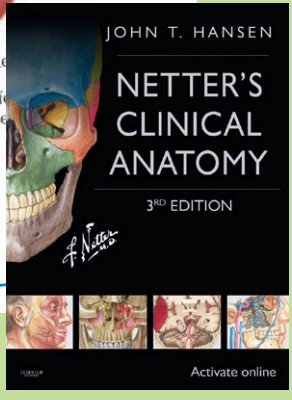


FIGURE 4-40 Hepatic Portal System of Veins.

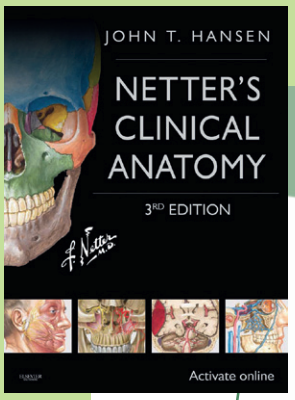
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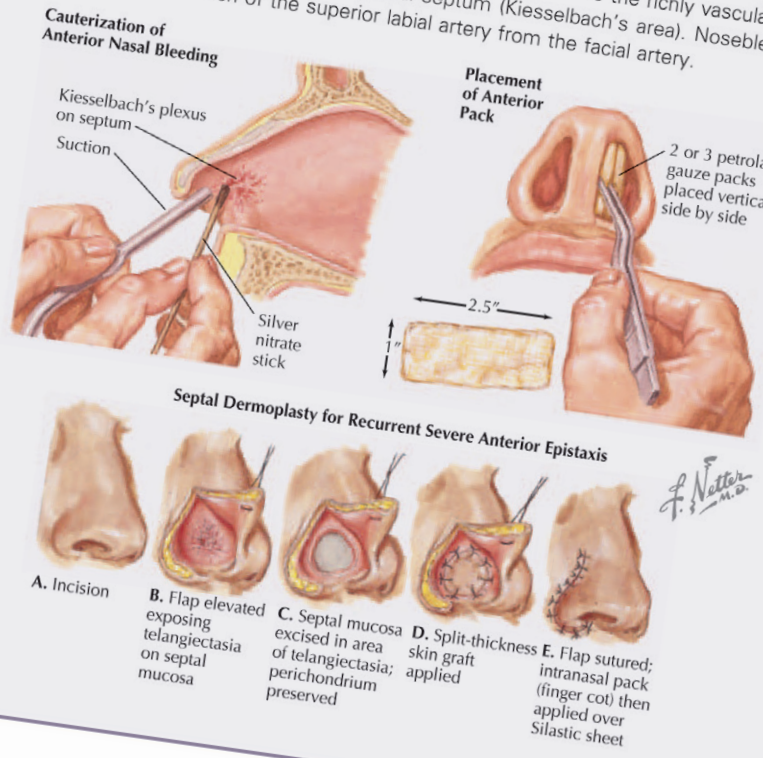
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Clinical Focus 8-33

Nosebleed

A nosebleed, or **epistaxis,** is a common occurrence and often involves the richly vascularized region of the vestibule and the anteroinferior aspect of the nasal septum (Kiesselbach's area). Nosebleeds usually result from trauma to the septal branch of the superior labial artery from the facial artery.



- **Frontal:** unpaired bone that contains the frontal sinus; forms part of the roof and septum of the cavity.
- **Vomer:** unpaired bone that contributes to the septum.
- **Nasal:** paired bones that form part of the anterior roof and lateral wall.
- **Maxilla:** paired bones that form the floor, septum, and lateral walls of the cavity.
- **Palatine:** paired bones that form the floor, septum, and lateral walls of the cavity.
- **Lacrimal:** bone that forms part of the lateral wall of the nasal cavity.
- **Inferior nasal concha:** paired bones that part of the lateral wall.

ply and Innervation

to the nasal cavities originates from major arteries (Fig. 8-33):

- **Ophthalmic:** anterior and posterior ethmoidal arteries
- **Maxillary:** sphenopalatine (terminal branch of the maxillary) and its septal branches, and the greater palatine arteries
- **Facial:** lateral nasal, septal branches, and superior labial artery

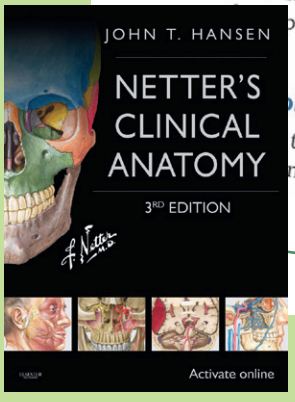
Corresponding veins drain the floor, lateral walls, and nasal septum, with most of the venous return passing into the **pterygoid plexus of veins** (Fig. 8-33). Some venous drainage also passes into the facial vein anteriorly and into the inf thalmic veins superiorly.

The innervation of the nasal cavit following (Fig. 8-34; see also Fig. 8-7

- **Olfactory:** CN I olfactory recep sense of smell) in the olfactory convey axons that pass from the

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